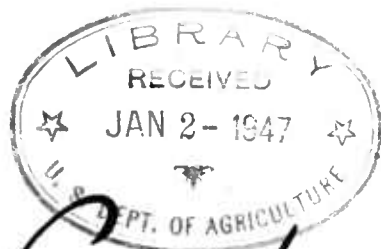


Historic, archived document

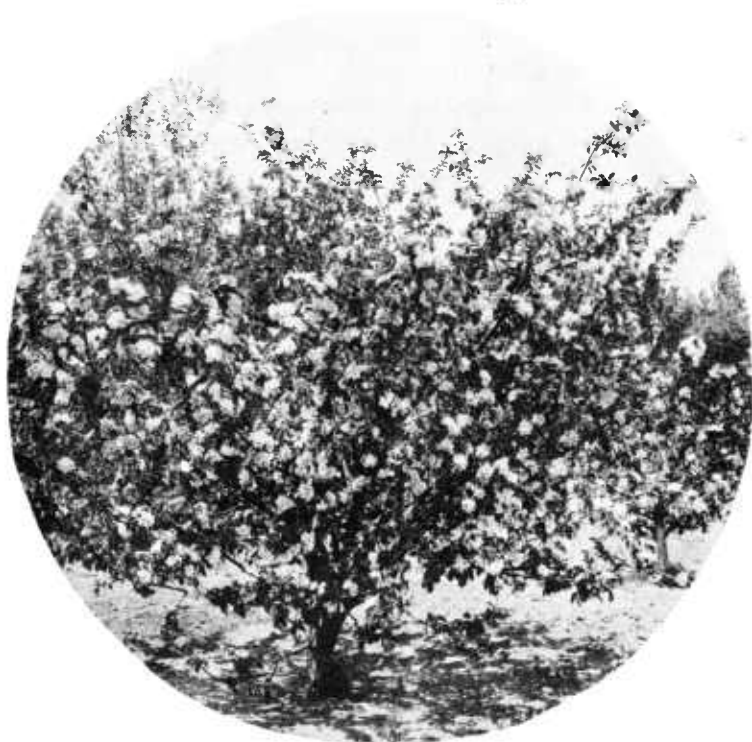
Do not assume content reflects current scientific knowledge, policies, or practices.

84F
cop. 5

Rev.



The *Home Fruit Garden*



on the
Northern Great Plains

FARMERS' BULLETIN *No. 1522*

**U.S. DEPARTMENT
OF AGRICULTURE**

COLD and drought make fruit growing difficult and consequently limit fruit production on the northern Great Plains; but if a suitable site is chosen, hardy varieties are planted, and the plants are given proper care, a farmer in this area should be well repaid for his efforts to grow fruit for home use.

In most locations the protection of a windbreak is essential to success.

The land should be well prepared, preferably by fallowing, so that planting may be done in moist soil.

First-class stock of hardy varieties from northern nurseries should be used. For the tree fruits, 1-year-old or 2-year-old trees should be planted and low-headed or bush-formed trees developed.

Cultivation, pruning, spraying, protection from rabbits and mice, and winter protection are essential.

The hardier varieties of apples, crabs, plums, plum hybrids, Bessey cherries, Juneberries, grapes, currants, gooseberries, raspberries, strawberries, and native fruits can be grown with a greater or less degree of success, depending on the district, site, and care given.

Peaches, pears, apricots, cherries, blackberries, dewberries, and nuts are not generally hardy, and, except for a few new introductions worthy of trial in sheltered sites, their planting cannot be advised.

THE HOME FRUIT GARDEN ON THE NORTHERN GREAT PLAINS¹

By W. P. BAIRD, *associate horticulturist, Division of Dry Land Agriculture, Bureau of Plant Industry*

Contents

	Page		Page
Value of the home fruit garden.....	1	Cultural methods—Continued.	
Area and topography.....	2	Pruning small fruits.....	24
Climatic features.....	3	Thinning fruit.....	27
Selection of a site.....	4	Control of insects and diseases.....	28
Protection from wind.....	6	Protection from rabbits and mice.....	30
Cultural methods.....	8	Special winter protection.....	32
Preparation of ground.....	8	Kinds and varieties of fruits.....	34
Ordering and care of nursery stock.....	9	Apples and crabs.....	35
Propagation.....	11	Plums and hybrids.....	40
Planting.....	11	Cherries.....	46
Spacing.....	12	Apriots.....	46
Cultivation.....	14	Grapes.....	46
Cover crops and manures.....	16	Small fruits.....	46
Intercropping.....	18	Native fruits.....	49
Irrigation.....	18	Planting plan for the home fruit garden.....	52
Pruning tree fruits.....	19		

VALUE OF THE HOME FRUIT GARDEN

Fruit gardens have been established slowly on the northern Great Plains, and those that have been planted are of small extent. This has been a result not only of the climate but of a lack of knowledge of hardy varieties and of cultural methods adapted to the area. Too many homes are without surrounding trees, shrubs, flowers, and fruits, all of which help so much to make the farm in any region an attractive place on which to live. Such plants are of special importance to the farmer on the Plains, where most of the land is devoid of natural tree growth, winds are often severe, and fruits are scarce.

The value of the home fruit garden on the northern Plains is far greater than can be measured by its return in dollars and cents. There is a pleasure and satisfaction in growing good fruit and picking it as it ripens in one's own garden that cannot be obtained by buying the same product in the store. Moreover, the market supply of fresh fruit is often limited and the price high, so the Plains farmer who depends on buying his fruit generally has less of it on the table than he should have, both for health and for the pleasure of a mixed diet. A liberal supply of fruit in the diet is decidedly beneficial. The fruit garden is an ornament to the farm, increases the value of the land, reduces grocery bills, and in favorable years may even add to the farm income, as any surplus should find a local market in this section where the supply of native-grown fruit is limited.

Commercial fruit growing probably will never be of great importance on the northern Plains. There are doubtless opportunities for farmers having experience and unusually favorable sites to grow fruits and vegetables for sale in local markets and to profit financially thereby, but this aspect of fruit growing is not considered in this bulletin. The problem of growing fruit for home use and its relation to the

¹ The information contained in this bulletin is based largely upon results obtained at the United States Northern Great Plains Field Station, Mandan, N. Dak.

building of more permanent and more attractive homes on the northern Plains is believed to be of far greater importance than any commercial-fruit problem of the area.

That it is possible to grow fruit for home use in most of this section can no longer be doubted. Experience has shown that it is not easy, but fruit growing requires careful attention in any region if best results are to be obtained. This is especially true of the northern Plains, where climatic factors make fruit growing particularly difficult. However, many persons have been determined to grow fruit and when overtaken by failure have been willing to learn, and to try again until they have achieved success. The experience of such persons and the results of work at State and Federal agricultural experiment stations clearly indicate that, given a suitable site, adequate protection from wind, hardy varieties on hardy roots, and cultural methods adapted to the area, the farmers on the northern Plains can grow fruit both to eat out of hand and for culinary purposes.

AREA AND TOPOGRAPHY

The northern part of the Great Plains, to which this bulletin applies, includes roughly the portions of North Dakota and South Dakota west of the one hundredth meridian and the Plains sections of Montana

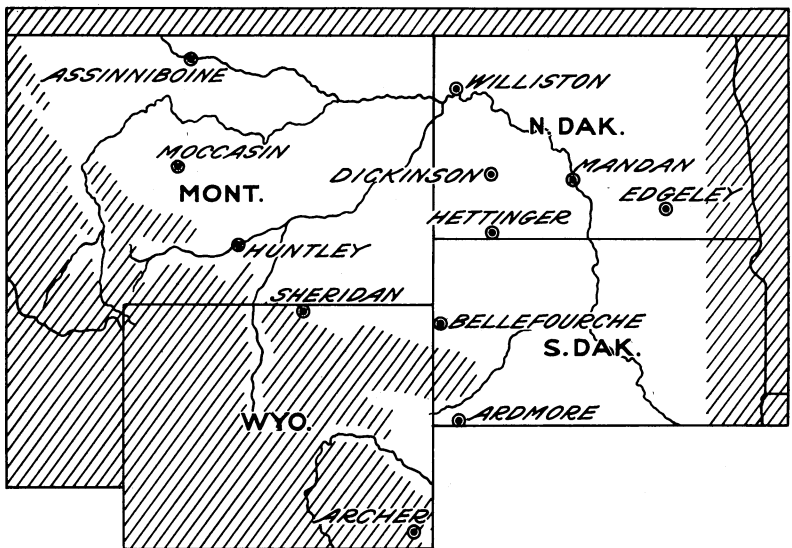


FIGURE 1.—Map of the northern Great Plains. The location of each field station in this section at which the Division of Dry Land Agriculture has conducted investigations is shown by a dot within a circle.

and Wyoming east of the Rocky Mountains, except for the southern districts of Wyoming and South Dakota, which belong to the Central Plains area (fig. 1).

Except for the Bad Lands districts, river valleys, occasional hills, and a few isolated groups of small mountains, the land is largely characterized by broad, rolling, treeless plains. Most of the area is drained by the Missouri River and its tributaries. The Mouse River

drains a portion of it in northern North Dakota. Over much of the area there is a gradual rise in elevation from the east to the west and also as the distance increases away from the valleys of the Missouri and Yellowstone Rivers. Altitudes of 1,500 feet are common near the Missouri River in South Dakota, but the elevation rises to 5,000 feet or more as the foothills of the Rocky Mountains are approached.

CLIMATIC FEATURES ²

The climate of the northern Great Plains has been classed as semi-arid, although variable from year to year in both the amount and distribution of the annual and seasonal precipitation. In general, the average annual precipitation decreases from east to west, ranging from 15 to 20 inches over most of the western parts of the Dakotas, and from 10 to 15 inches over much of the Plains sections of Montana and Wyoming. Exceptions occur, as in the Black Hills, which is a district of comparatively heavier rainfall.

The type of precipitation on the northern Plains is characterized by comparatively heavy rains in late spring and early summer and light precipitation in fall and winter. Normally, almost 50 percent of the annual precipitation falls in the 3 months of May, June, and July, and the seasonal precipitation from April 1 to September 30, inclusive, ranges from 60 to more than 80 percent of the annual, being approximately three-fourths of the annual precipitation over much of the territory. June is generally the month of heaviest precipitation.

The seasonal evaporation from April 1 to September 30, inclusive, from a free water surface ranges from about 32 to 33 inches near the Canadian border to 38 or 39 inches near the South Dakota-Nebraska boundary line.

This part of the Great Plains is subject to severe drying winds at all seasons of the year. March, April, and May are generally the more windy months. The prevailing wind direction is from the west or northwest over a large part of the area. South winds during the summer are sometimes hot and dry and consequently very trying to horticultural plants.

The average date of the last killing frost in the spring varies from May 1 to May 31 in different parts of the northern Great Plains, and the average date of the first killing frost in the fall varies from September 1 to September 30. Thus the average length of the frost-free period ranges from about 90 to 150 days. In most of western South Dakota and in districts close to the Missouri or Yellowstone Rivers in North Dakota and Montana, the average frost-free period generally ranges from 120 to 150 days, whereas in other parts of the northern Plains an average frost-free period of only 90 to 120 days generally obtains. As a rule, the length of the growing season decreases with increases in altitude, and to some extent from south to north.

This area is characterized by long, cold winters and short, warm summers. Winter temperatures of -40° F. or lower have been recorded at most Weather Bureau stations located on the northern

²This brief characterization of the climatic features of the area is largely adapted from the following: KINCER, J. B. PRECIPITATION AND HUMIDITY. U. S. Dept. Agr., Atlas Amer. Agr., pt. 2, sec. A, 48 pp., illus. 1922.

REED, W. G. FROST AND THE GROWING SEASON. U. S. Dept. Agr., Atlas Amer. Agr., pt. 2, sec. I, 12 pp., illus. 1918.

Plains, and summer temperatures of 100° F. or more may be expected, except at the higher elevations, where lower summer temperatures and cooler nights prevail.

Some climatic factors that tend to make fruit growing especially difficult are—

Low annual precipitation and uncertain periods of drought.

Long, cold winter.

Strong drying winds, which may occur at any season of the year.

Dry atmosphere and a high rate of summer evaporation.

Comparatively short growing season, with the possibility of damaging frosts either in late spring or early fall.

Sudden changes of temperature, especially in the winter, and alternate freezing and thawing in the spring.

Light snow covering during the winter.

Occasional hail.

These adverse climatic factors may occur in many different combinations. Their combined effect is to make the northern Great Plains one of the most trying areas in the United States for fruits. Winter-killing probably results from a combination of drying, cold, and other factors rather than from low temperature alone. Young trees that have not become well established are especially subject to such winter injury. Many older trees that have been weakened by drought, competition with other plants, insects, diseases, overbearing, or mechanical injuries are unable to survive the cold winters and drying winds.

Periods of relatively low precipitation extending over several years may occur, as was the case over much of the area from the fall of 1932 until 1938. Drought damage was especially severe in 1934 and 1936, when annual precipitations at Mandan were only 8.13 inches and 6.43 inches, respectively. Records at Bismarck, N. Dak., extending back over 60 years, show no other instance of the annual precipitation falling below 10 inches. It is not surprising that fruit plantings in the northern Plains suffered severely during this period of drought and some growers experienced a total loss, making it necessary to start all over again.

However, those were exceptional years, and not all the climatic conditions are adverse. Fungus diseases and some insect pests are not so likely to be troublesome as in more humid regions. The clear skies and bright sunshine may cause sunscald on the southwest side of a tree during the winter and early spring, but they hasten the ripening of the fruit during the short growing season and give it a desirable color. Some fruits, such as currants and gooseberries, do not thrive in the hot climate of the southern latitudes but flourish in the cooler climate of the north. Other fruits, such as Bessey cherries (western sand cherries), are not adapted to humid regions but thrive in the dry atmosphere of the Plains. The obvious thing to do is to select those fruits that are at least in some degree adapted to the climatic conditions that obtain and not attempt to grow fruits that lack hardiness or the ability to withstand periods of drought.

SELECTION OF A SITE

The selection of a site for the home fruit garden is of fundamental importance. If possible, it should be close to the farm buildings for convenience in properly caring for it and gathering the fruit and because it adds to the attractiveness of the home. However, if the

buildings are on poor, rocky, or alkaline soil, on the top of an exposed hill, on a steep south slope, or in a hollow or depression in which cold air or floodwaters are liable to collect, it would be better to select some other place on the farm where the soil and exposure are better suited to fruit growing.

Occasionally the site may be chosen to utilize run-off waters from higher ground during heavy rains. Furrows aid in diverting such floodwaters to the selected site, but if the slope is steep, washing of the soil may occur.



FIGURE 2.—Part of an orchard planted in a coulee at the United States Northern Great Plains Field Station, Mandan, N. Dak. Photographed when 5 years old. This planting later developed soil-erosion problems.

Comparatively level land is best for the fruit garden. A steep slope should be avoided, as cultural operations on it become difficult, water is lost by run-off during heavy rains, and washing of the soil is almost sure to occur under a system of clean cultivation. If irrigation is contemplated, it is especially desirable to select land that is fairly level, as it is very difficult to irrigate properly rolling or uneven land and steep slopes.

If sloping land is chosen, a north or northeast slope is to be preferred. On such a slope trees bloom later in the spring than on a decided south slope, thus tending to escape late-spring frosts; furthermore, trees and ground are not so subject to alternate freezing and thawing in the spring; a snow cover remains on the ground, protecting the roots for a longer period; there is better protection from drying south winds in summer; and the trees are less exposed in winter and early spring to the bright afternoon sun, which so often causes sunscald and ultimate death. Evaporation is greater from a south than from a north slope, so, although each receives an equal rainfall, plantings on the south slope are more subject to injury from drought.

Native vegetation indicates the advantage of a north slope, as many hills have trees and brush on the north side, whereas only grass is found on the drier southern aspect.

Good air drainage is necessary, and fruit trees should never be planted in a hollow or pocket from which cold air cannot drain away to lower levels. Generally speaking, trees on the higher lands of a locality have a better chance of escaping frost damage in late spring or early fall than trees on the lower lands; but this does not mean that fruit trees should be planted on the tops of exposed hills. A well-drained coulee with a gentle slope would be much better, as it would afford a certain amount of protection from wind, catch more snow during winter, and supply more water. However, coulees with steep slopes should be avoided (fig. 2).

The soil should also be considered in selecting the site for the home fruit garden, although fruit trees and small fruits adapt themselves to a fairly wide range of soils and generally will succeed on land that is fit for general farming. A well-drained, fairly rich loam or sandy loam from 6 to 8 feet in depth would be ideal, but either the more sandy or the heavier soil types will produce good fruit. Shallow soils less than 2 feet in depth, soils underlain with coarse gravel, rocky land, and alkaline soils should be avoided.

PROTECTION FROM WIND

The fruit garden on the northern Plains will thrive largely in proportion to the extent to which it is protected from wind. This protection may be in the form of natural hills or mountain ranges, native timber, buildings, or trees planted for windbreaks. One of the most striking things observed in the horticulture of the area is that wherever successful fruit growing is found there is also found adequate protection from wind. If natural protection is not available—and it is not available to the great majority of Plains farmers—windbreaks should be planted and grown to a height of at least 5 or 6 feet before fruit growing is attempted (figs. 3 and 4).

Experience indicates that over much of the area protection from the prevailing west winds and from the hot, drying, south winds of summer is of most importance. There should be protection also from the cold, drying, north winds of winter. Protection on the east is of least importance.

A good windbreak protects the fruit garden from drying winds throughout the year; it prevents fruit from being blown off, and limbs and foliage from being broken and lashed about by the wind; the calmer air encourages bees and other insects, which are so essential to pollination, to work freely at blooming time; it furnishes a home for insect-destroying birds; and it aids in collecting and holding an even cover of snow, thus protecting the roots during the winter. The windbreak is on duty protecting the fruit garden at all seasons of the year, and it is almost useless to consider growing fruit on the Plains without such protection.

The windbreak for the fruit garden may present a width of from one to five rows, the rows being spaced 10 to 12 feet apart, and, except for the outside row, the trees planted about 6 feet apart in the row. The following arrangement is suggested for a five-row planting, starting with row one at the outside (farthest from the orchard) and ending with



FIGURE 3.—A windbreak protecting a small fruit garden from west winds at the Northern Great Plains Field Station.



FIGURE 4.—A small-fruit planting with a plum orchard in the background and a windbreak at the right. Northern Great Plains Field Station.

row five on the inside (nearest the orchard): Trees having a low branching habit are desirable for the outside row, and the Siberian pea-tree, or Caragana, is one of the best of this type. Lilac or Tatarian honeysuckle may be substituted for the Siberian pea-tree in districts where insects are very troublesome to the latter. Row two may be Russian-olive; row three American or Chinese elm; row four green ash; and row five chokecherry.

In a three-row windbreak, row one may be the same as in the five-row planting, row two either American elm or Chinese elm, and row three either Russian-olive or chokecherry.

Russian-olives planted 4 feet apart form one of the best single-row windbreaks.

One or more rows of evergreens may be desirable on the inside, next to the orchard or buildings. Scotch pine, jack pine, blue spruce (Colorado), and western white spruce (Black Hills) are considered the hardiest and best evergreens for this purpose.

A snow trap is sometimes advised to prevent snow from piling up within the windbreak and orchard and breaking the trees. However, if the first row of fruit trees is planted about 50 feet from the windbreak, most of the drifts will accumulate within the windbreak and between it and the fruit trees. The melting snow will benefit both, and the danger of breakage is not great. For these reasons, a snow trap is not advised under most conditions.

CULTURAL METHODS

Fruit trees and bushes require care and attention wherever they are successfully grown, and cultural methods become of particular importance on the northern Plains where the climatic conditions are adverse. The results depend largely on the care given. Many problems are yet to be solved, and the best cultural practice for one district may not always be the best for a neighboring district, or the best cultural practices for one season may not be the best for another. It is obviously impossible to give complete directions that will fit all conditions and varying seasons, but it is believed that the following general directions will be of help in taking care of the home fruit garden. Recommendations are to a large extent based on experimental work conducted at the United States Northern Great Plains Field Station, near Mandan, N. Dak., and on observations made on trips through the area.

PREPARATION OF GROUND

Half an acre to an acre of ground will generally be found sufficient for the home fruit garden. The land should be properly prepared for planting. Never plant on newly broken sod. It is best to crop such land for a year and then to fallow it for a year before planting the fruit trees and bushes. It is not considered advisable to plant after a grain crop. Either cultivated crops, such as corn or potatoes, or preferably clean summer fallow for a year should precede planting, as the stand and growth of the young trees and bushes will depend largely on the supply of water in the soil at planting time.

Summer fallow during the year before the nursery stock is planted is the best method for preparing land in the Great Plains. If properly handled, it will store needed water in the soil and at the same time

effectively kill out grass and weeds. Fallow should be plowed in the spring before the first of June and cultivated during the entire growing season as often as necessary to keep the land free from weeds. A shovel or duckfoot cultivator is the best type of implement for the cultivation of fallow. The surface should be roughened by a cultivation late in the fall to aid in holding snow and to lessen soil blowing. The fallow should not be plowed again, as a firm, well-settled soil is best for planting nursery stock.

If the proposed site was cropped during the summer preceding the planting of the fruit garden, it should be plowed to a depth of 7 or 8 inches soon after the crop is harvested. The land should then be left rough over winter, as the rough surface protects the soil from blowing and tends to catch and hold drifting snow. If the land starts to blow in early spring, it should be worked with some form of a shovel cultivator which will leave the surface in a rough or ridged condition.

A dressing of well-rotted manure may be turned under at the time of plowing and would be especially desirable for light sandy land, heavy clay, or any soil lacking in fertility. However, this is not necessary for most of the fertile soils of the Plains, where drought, cold, and wind, rather than the lack of plant food, are the factors limiting growth.

As an additional measure for holding snow and supplying water for the future trees and bushes, it is sometimes advisable to plow furrows along the lines where the rows will be or even to dig holes for the trees in the fall. The furrows or holes may be filled with snow, and the surrounding ground be well moistened and in good condition for early planting when it melts in the spring. Furrows should not be run in the direction of the land slope, as washing is liable to occur.

If the orchard is planted on sloping land, terracing along contours to prevent surface run-off and soil erosion is desirable. Tree rows should follow contours so far as practicable, so that cultivation may be across rather than up and down the slope. Every effort should be made to prevent run-off, as the trees will require all the water that falls. One sees striking examples of fruit trees dying from drought on a slope, whereas the same varieties are healthy on nearby level lands.

ORDERING AND CARE OF NURSERY STOCK

It is advisable for prospective fruit growers on the northern Plains to obtain their planting stock from reliable nurseries situated in or near the district in which they live. Shipping charges are then less, the stock is more likely to arrive in good condition because of the shorter time on the road, and such nurseries are more likely to list hardy varieties suited to the district and propagated on hardy roots. Upon request a list of nurserymen will be supplied by the United States Northern Great Plains Field Station, Mandan, N. Dak. Stock should be planted while it is perfectly dormant, that is, before the buds start to swell or the leaves to form. There is liable to be more trouble with southern-grown stock starting into growth before the land in the north is ready for planting than would be the case with northern-grown stock.

Nursery stock may be ordered for either fall or spring delivery, but if it is shipped in the fall, it should reach the farm before the ground freezes, so that it may be properly heeled in for the winter. By

ordering early, either in fall or early winter, the farmer stands a better chance of obtaining the varieties he wants before the nurseryman has exhausted his supply, and the shipment arrives in time for early planting.

Only first-class trees should be purchased. Such trees are not necessarily the largest, but they should be medium-sized, thrifty, and free from disease. Well-developed root systems should be insisted upon. Never buy small, weak, stunted, or diseased trees, no matter how attractive the price.



FIGURE 5.—Trees heeled in, in moist soil until spring planting time.

As a rule, 1-year-old trees are to be preferred to 2-year-old trees. They are cheaper, as good or better stands are usually obtained, and there is a better chance to form the heads low and to train the trees as desired. The nurseryman often trims 2-year-old trees in such a manner that it is very difficult to develop from them the low-headed or bush-type tree recommended for the Plains.

Shipments of nursery stock should be made by express or parcel post rather than by freight, as freight shipments usually are so long on the road that the roots dry out. The shipment should be called for promptly and should be inspected as soon as the farm is reached. If the roots or twigs appear dry, they may be freshened by being soaked for a day in a barrel of water placed in the shade or by completely covering the tree or plant with moist earth. Any trees with wartlike growths called crown galls on the roots should be discarded. Be careful not to let the roots dry out while the stock is being handled. It should be promptly heeled in, in a well-drained, cool place, as on the north side of a building, until planting time.

To heel in trees, a trench with one sloping side is dug deep enough to admit the roots. The trees are then laid down at right angles to the trench, with the roots in the trench and the tops near the ground on the sloping side, the trees in the bundle having first been separated so that fine, moist soil may be thoroughly worked around all the roots. After the soil is packed around the roots the ground may be well watered as a further precaution against drying out, and then more soil thrown on until the roots are covered to a depth of several inches (fig. 5). If the trees are likely to remain heeled in for a considerable time, especially if they are buried in the fall to remain over winter, the tops should be partly covered with moist soil. Care should be taken that the soil around the roots does not dry out at any time, but it should not be waterlogged. Trees are left heeled in until planting time, but they should be planted before the buds start to grow. Shrubs, vines, and bushes are treated the same as trees.

PROPAGATION

Fruit varieties are propagated by vegetative means, as seedlings differ both from the parent and from each other. A few may be good, but most will produce fruit inferior to the parent. Most tree fruits are propagated by budding or grafting, but many small fruits are propagated from cuttings or root sprouts. Successful propagation requires considerable skill and experience, so it is generally advisable to purchase plants from a reliable nursery. For those interested, detailed information on propagation may be found in Farmers' Bulletin 1567, Propagation of Trees and Shrubs.

PLANTING

It is especially important that trees be planted very carefully on the northern Plains, because much depends on their starting growth promptly and making a fairly vigorous growth during the first summer. Trees that are carelessly planted dry out, and many fail to grow; or if they start growth it is usually very late in the season, a weak growth is made during the summer, and they are very susceptible to winter injury.

As fall-planted fruit trees are in some danger of drying out and winter-killing during the long, cold winter, it is advisable to plant in early spring, soon after the frost is out of the ground. April planting is probably best over most of the northern Plains.

Unless the soil has ample moisture, the trees should be well watered at planting time. A shallow trench, large enough to receive a bucket of water, should be left or made around each newly planted tree. After the water soaks in, the trench should be filled with loose soil. If planting is followed by several weeks of dry weather, it may be necessary to water again, following the same method. Everything should be done to encourage the tree to start growth quickly and to become well established the first summer.

Small fruits are planted much the same as trees, except, of course, that the holes are smaller to correspond to the size of the root system. Bushes are planted a little deeper than they stood in the nursery. Strawberries should be planted at the same depth they formerly grew.

The same care is necessary to prevent the roots from drying out, and because of their shallower root system it is even more important to water at planting time and to repeat the operation as needed until the plants become well established.

All fruit trees should be cut back when planted. If the trees are 1-year-old whips, they should be cut back to 15 or 20 inches from the ground. If 2-year-old trees or well-branched 1-year-old trees are planted, the branches that are to form the framework of the tree should be cut back to within 6 to 8 inches of the main stem and all other branches removed. Suggestions for selecting the main branches are given under Pruning the young tree, on pages 20 to 22.



FIGURE 6.—Self-protecting fruit patch at the Northern Great Plains Field Station. The trees were planted in 1919 in rows 12 feet apart and spaced 4 feet and 6 feet apart in the row. Bush-formed trees were developed. Because of drought injury and poor quality of fruit under this system of close planting, about one-half of the trees were thinned out in 1931.

Small fruits also should be cut back at planting time, as the top of the plant should be reduced to correspond to the loss of a large part of the root system. All blossom buds and part of the leaves should be removed from strawberry plants.

SPACING

There is little experimental evidence to determine the best spacing of fruit trees on the Great Plains. If the trees are widely spaced, each has a large area of soil from which its roots can draw moisture, and if they are closely spaced in groups or hedgerows, they may protect one another and hold snow. Perhaps each system has its place, and no rule can be laid down that will be best for all conditions. A spacing experiment has been in progress at the Northern Great Plains Field Station since 1922, but results have not been conclusive. The closer

spacing resulted in better stands and less winter injury in the earlier years but in a heavier loss and more drought injury in later years. Apple trees widely spaced in the variety trial orchard came through the drought with less sunscald and in much better condition than the same varieties in closely planted blocks. In general the fruit produced in one closely spaced planting started in 1919 (fig. 6) has been small and of poor quality, due to lack of vigor in the individual trees. About half of the trees in this experiment were pulled out in 1931, with the result that the remaining trees have become more vigorous and have produced larger fruit of better quality.

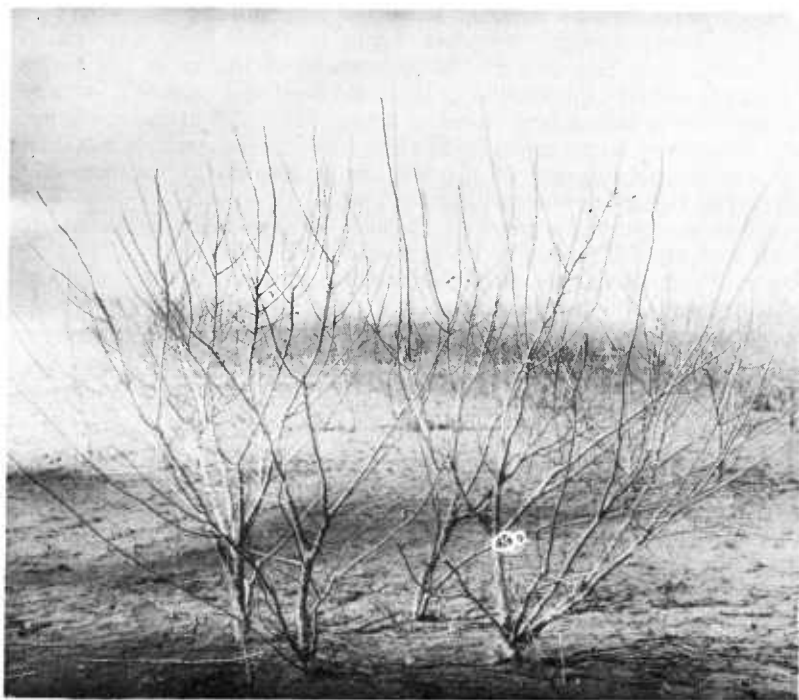


FIGURE 7.—Plum trees planted in groups of four in the planting-systems experiment at the Northern Great Plains Field Station. This system is recommended only under special conditions.

Most of the evidence points to the advisability of planting fruit trees at standard distances. These distances may be a little closer than recommended for commercial fruit-growing sections, as few fruit trees grow very large on the northern Plains without irrigation. On low, rich lands with an underground water supply, greater distances than those given may be used to advantage. The following spacings are suggested for ordinary conditions: Apples and crabs, 20 to 25 feet; plums, 15 to 18 feet; plum hybrids, 12 to 16 feet; Bessey cherries, serviceberries (Juneberries), and grapes, about 8 feet each way, or in rows 10 feet apart, with the bushes 8 feet apart in the row; currants, gooseberries, and raspberries, rows 6 to 8 feet apart, with the plants 5 feet apart in the row; strawberries, rows 3 to 4 feet apart, with the plants from 1 to 2 feet apart in the row.

However, if the site for the fruit garden lacks protection from wind and conditions are unusually adverse, it might be advisable to plant so that the trees would have every opportunity to protect one another and hold snow. Under such conditions trees may be planted in rows 15 to 25 feet apart and spaced 8 to 10 feet apart in the row (fig. 6) or in groups of 4 trees, 2 feet apart, the groups being spaced from 15 to 25 feet apart (fig. 7). The wider distances are suggested for apples and crabs and the smaller for plums. In each type of spacing, bush-formed trees should be developed, branching taking place at or very near the surface of the ground. As a further protective measure, the rows may be run from northeast to southwest so that the closely planted trees will shade one another from the afternoon sun.

Under adverse conditions when other methods fail, close planting often results in a fair stand. If 25 percent of the trees fail to grow, the result is not so undesirable as it would be if wide spacing were used, because there is still a fair stand of trees. If a full stand is obtained, all the trees may be retained until their need for protection has passed, when a sufficient number of the weaker or less desirable trees should be removed before overcrowding begins.

Fruit trees should be planted at least 30 feet from the windbreak, and 50 feet would probably be preferable in most cases. The space between the fruit garden and the windbreak may be used for strawberries or vegetable gardens for a few years, or until the trees require all available moisture.

CULTIVATION

Referring to the relation of cultural practices to winter injury, J. H. Gourley, of the Ohio Agricultural Experiment Station, has made the following statement: "Practices which maintain a strong vigorous tree and yet permit normal maturity are likely to reduce danger from winter injury."³ On the northern Plains one of the main problems is to keep the trees and other plants in a vigorous, thrifty condition and prevent their being weakened by drought, as many plants so weakened are unable to survive the winter. Consequently, clean cultivation throughout the growing season is recommended. This should be frequent enough to prevent weeds from making any considerable growth. Besides preventing loss of moisture through weeds, clean cultivation with a coarse, granular surface facilitates the penetration of water from rains, reduces run-off, and protects against soil blowing.

It is commonly advised to cease cultivation late in July or early in August in order to encourage early ripening of the wood and prevent a late sappy growth that might be susceptible to winter injury. It is doubtful if this advice is sound on the Plains, except in unusually wet seasons or for young trees that may be growing too vigorously. As a general rule, there is no excess moisture in the soil in late summer or early fall, even when cultivation is continued. If it is not continued, bearing trees may suffer from drought in a dry season and enter the winter in a weakened condition. So it would seem best to start cultivation as soon as weeds begin to grow in the spring, ordinarily late in April, and continue as needed until September. A man with

³ GOURLEY, J. H. *TEXTBOOK OF POMOLOGY*, p. 275. New York, 1922.

a hoe should always follow the cultivator and remove weeds close to the trees and plants. Deep cultivation or plowing should not be necessary. The type of orchard cultivator shown in figure 8 leaves the surface of the ground in a ridged or furrowed condition, which is desirable to check soil blowing and kills weeds effectively if they are



FIGURE 8.—Orchard cultivator in use at the Northern Great Plains Field Station.

not allowed to get too large. As a further aid in checking soil blowing, furrows are often plowed between the rows late in the fall or early in the spring (fig. 9).

A disk harrow or cultivator may be used to advantage after a cover crop or when there is considerable straw or other rubbish on the land, as it does not clog up as easily as the shovel type of cultivator. The disk is also less liable to catch and break roots. However, it tends to pulverize the soil and leave it in a condition favoring soil blowing, and if the gangs are not reversed in succeeding cultivations the soil is piled up excessively along the rows, and deep furrows are made between them.

In cultivating the orchard, care should be taken that neither horses nor implements break or bruise the trees, as such wounds do not heal readily in the dry climate of the Plains. If a tree is damaged, smooth the edges of the wound with a sharp knife and wrap it with burlap or some other material to prevent excessive drying. A coat of white-lead paint or a mixture of coal tar and creosote may be applied to the wound.

If the slope is very steep, loose soil is readily washed away by rains, and cultivation may be impracticable. On such slopes a straw or hay mulch may be substituted for clean cultivation. This should

be heavy enough to prevent weed growth, and care should be taken that fire does not start in the dry mulch. Each tree must be protected from mice by being wrapped with fine woven wire or by other means.



FIGURE 9.—Furrows plowed between rows of fruit trees to check blowing on a sandy soil.

COVER CROPS AND MANURES

In most regions cover crops and green manures have a very important place in maintaining the fertility of orchard soils. Many instances have occurred where continued clean cultivation tended to deplete the humus supply of the soil—which is naturally low in semi-arid regions—and finally resulted in an unproductive orchard. In referring to experiments with cultural practices under irrigation conducted near Victor, Mont., H. Thornber writes: "Continuous clean cultivation proved to be wholly unsatisfactory from the standpoint of either tree growth or fruit production." He advocates plowing under green crops, preferably legumes such as clover, in order to maintain soil fertility and to prevent the exhaustion of organic matter.⁴

Besides tending to keep up the supply of humus in the soil, a cover crop may prevent soil blowing at certain times of the year; and, if not plowed under until spring, it may aid in catching and holding snow in the orchard during the winter. In fact, there can be little doubt of the value of green-manure or cover crops in irrigated districts; but in spite of the benefits derived, it is doubtful if they can be recommended for the dry-land fruit grower on the northern Plains.

⁴ THORNER, H. ORCHARD CULTURAL PRACTICES. Mont. Agr. Expt. Sta. Bul. 156, 19 pp., illus. 1923.

Such crops compete with the trees for moisture and, by causing the trees to suffer from drought, may do far more harm than good. At least their use should be restricted to unusually wet seasons and to vigorously growing young trees. Small fruits are planted so close that cover crops should not be attempted with them.

If a cover crop is sown, experience at the Northern Great Plains Field Station indicates that about the middle of July or a little later is the proper time for seeding. Oats, millet, and peas have been used with fair success (fig. 10). The cover crop should not be planted within 6 feet of the trunks of the trees.



FIGURE 10.—A cover crop of millet in the Hibernian apple orchard at the Northern Great Plains Field Station.

Whenever possible, it is desirable to use manure in place of cover crops to keep up the humus supply and fertility of the soil in the dry-land orchard. If a light dressing of well-rotted stable manure is applied every year, or even once in 2 years, there should be no ill effects from continued clean cultivation. However, manure does not readily rot under Great Plains conditions, and the excessive application of manure may actually injure the trees. Such results are evident in one of the cultural experiments at the Northern Great Plains Field Station, where blocks of trees that have been manured heavily over a period of years are in weaker condition than those in clean-cultivated blocks or in blocks receiving other treatments. The application of a straw mulch in the wintertime, combined with clean cultivation in the summer, has given good results in a test of cultural methods.

INTERCROPPING

Any crop grown between the fruit trees competes with them for moisture, and for that reason intercropping cannot generally be advised. However, if wide spacing is used (rows 25 feet or more apart) a few rows of some cultivated crop or even one or two rows of small fruits may be grown between the rows of tree fruits for a few years. A few rows of corn may be grown between young trees, and if the stalks are left standing over winter they afford some protection and aid in catching snow. The danger lies in continuing this practice too long, as the trees would be weakened by competition with the intercrop.

IRRIGATION

Although desirable, irrigation is not generally available to the Plains farmers and is not necessary for trees that are otherwise properly cared for. It is especially needed for such small fruits as strawberries and raspberries, which often fail under dry-land conditions because of drought.

If irrigation water is available, it may be used at any time that signs of suffering from drought are shown. Generally a good irrigation in May or June and another in July to size up the fruit should be sufficient during the growing season. In dry years, a third irrigation is desirable late in the fall when there is no danger of starting the trees and bushes into active growth. The later this is applied the better, as the object of this irrigation is to prevent drying out and consequent winter-killing during the long winter and the following spring. A



FIGURE 11.—Dirt embankments made to catch run-off water and prevent the washing of soil in the orchard of the late John Robertson, near Hot Springs, S. Dak.

straw or hay mulch applied soon after this late-fall irrigation will lessen evaporation.

It is better to irrigate thoroughly a few times than to apply frequent light irrigations. The soil should be wet to a depth of at least 4 or 5 feet at each irrigation. Either the furrow or the basin system of applying water may be used. A windmill or a small gasoline engine is sufficient to furnish irrigation water for most fruit and vegetable gardens. If irrigation is contemplated, comparatively level land should be selected for the fruit planting, so that excessive leveling will not be required.

If there is higher ground above the site, run-off or floodwaters may be utilized for irrigation purposes by plowing furrows to divert the run-off water to the fruit garden. It may be desirable to terrace the orchard in order to prevent such water from running quickly away or washing the soil. In some orchards ridges are thrown up around or on the lower side of individual trees or groups of trees or bushes to aid in holding run-off water (fig. 11).

PRUNING TREE FRUITS

Pruning is often neglected in the home orchard or so done that the result is worse than no pruning at all. In considering pruning for the Plains area, it is well to remember that large pruning wounds do not readily heal here and that the sunlight is more intense than in more humid regions; consequently, the branches should be left a little thicker, to shade properly the main limbs and trunk, particularly on the west and south sides of the tree. In other words, pruning should



FIGURE 12.—An apple tree which has been headed too high. The bark on the southwest side of the trunk has been killed by sunscald.

not be so severe on the northern Plains as in most regions. It is better to practice a light annual thinning out of small limbs rather than any severe heading back or periodic removal of large branches. If



FIGURE 13.—A low-headed Virginia crab tree at the Northern Great Plains Field Station.

a careful annual pruning is practiced from the start, removal of large branches should not be necessary.

Some objects of pruning are—

To influence the form of the tree.

To build a strong framework that will not easily break in the wind or under loads of fruit in later years.

To remove interfering, dead, or broken branches, water sprouts, and root sprouts.

To thin out top branches where they are too thick and produce more shade than is desirable for fruiting spurs and twigs in the center of the tree.

To thin fruits.

Pruning the Young Tree

The purpose of pruning during the first few years is mainly to shape the tree as desired and to develop a strong framework. If well-branched trees are planted, the main or scaffold limbs are selected when the trees are pruned just after planting. If 1-year-old whips are planted, the scaffold limbs are selected in the following spring. Suggestions for choosing the scaffold limbs follow.

Not less than three nor more than six main branches should be selected.

Develop a low-headed or bush-form tree. The lowest branch should be less than 1 foot from the surface of the ground and preferably on the southwest side of the tree. This will, of course, be impossible with trees that have been trimmed up high in the nursery. An old high-headed apple tree that is suffering from sunscald is shown in figure 12. The Virginia crab shown in figure 13 has a much more desirable form. The main branches should start from the trunk at different levels; that is, there should be a space of 4 to 6 inches vertically between the different branches. If two or more limbs leave the trunk at the same height, they are more liable to split down with a heavy load of fruit in later years. The vertical distribution of the scaffold limbs is shown in figure 14.

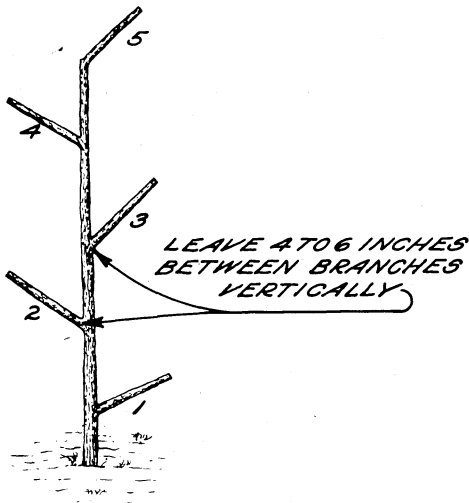


FIGURE 14.—Vertical arrangement of scaffold branches. No two should leave the trunk at the same height from the ground.

The branches should be so arranged around the trunk that a symmetrical tree is formed; that is, each branch should point out in a different direction. No scaffold branch should be directly above another. The horizontal arrangement of the scaffold limbs is shown in figure 15.

All scaffold branches should form a wide angle with the trunk of the tree, as sharp-angled branches are liable to split down and seriously damage the tree in later years. Figure 16 illustrates wide-angled and sharp-angled branches.

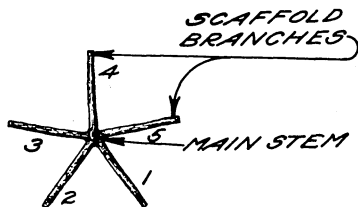


FIGURE 15.—Horizontal arrangement of scaffold branches. They should be arranged around the trunk so as to form a symmetrical tree.

In removing superfluous branches, cut them off close to the trunk.

These suggestions refer to an ideal tree, which will seldom be found. The pruner should, however, keep such an ideal in mind and develop each tree as nearly like it as possible, remembering that every tree represents an individual problem.

The pruning after the second season's growth, or after the first season's growth if 2-year-old branched trees are planted, has for its main object the further development of a strong framework. One to three (generally two) well-placed branches are allowed to remain on each scaffold limb, and from a fourth to a half of the annual growth is removed from them. If the branches are long and thin, they may be cut back more severely. If two branches that form a sharp angle are allowed to remain, one should be cut back more severely than the

other, which subordinates it to the longer branch. It is doubtful if any further heading back is desirable, except possibly with plum hybrids or to suppress any limbs that may be growing too vigorously at the expense of others.



FIGURE 16.—Branches of a tree, especially the scaffold limbs, should join the trunk at a wide angle, as shown in A. The sharp angle shown in B is liable to split down when the limbs grow older.

Little pruning is necessary for the next few years, except thinning out to prevent the formation of too many limbs and removing undesirable branches, such as one of two limbs which may interfere or rub each other, or water sprouts, root sprouts, and dead or broken limbs. Figures 17 and 18 show a 3-year-old crab tree before and after pruning.

Many young trees suffer severe winter injury, particularly during the first and second winters after planting. Some are killed back to

the surface of the ground, and new sprouts spring up that may or may not be of the variety desired, depending on whether the sprouts start from above or below the union of the bud or scion with the root. The origin of such sprouts should be carefully determined and any from the root removed. From one to four sprouts starting above the union of the scion and stock should be selected and used to form the framework of a low, bush-type tree. If one is selected, the pruning is essentially the same as on a newly planted tree. If all sprouts appear to be from the stock or root, it is best to pull the plant out and replace it with a new one from the nursery, as root sprouts probably will bear small, inferior fruits.

Pruning the Bearing Tree

A light but regular annual pruning during the dormant period is recommended for bearing trees. This pruning should take the form of a light thinning out of superfluous branches in the top of

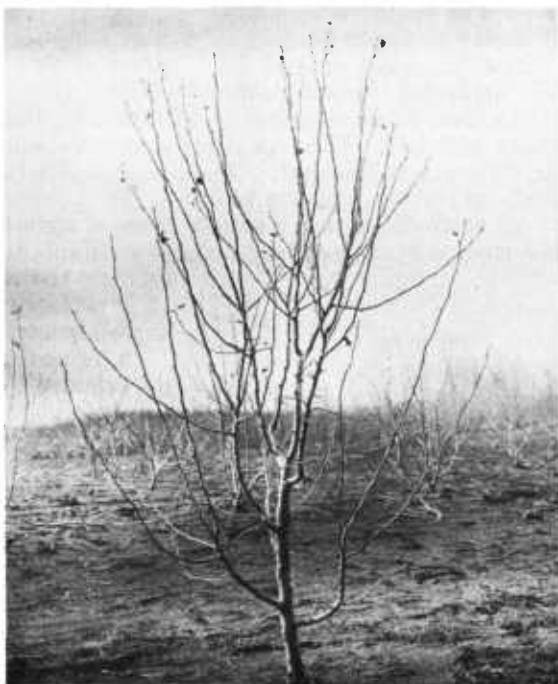


FIGURE 17.—A 3-year-old Hyslop crab at the Northern Great Plains Field Station before pruning.

the tree, so as to admit light to the main limbs and the center. This encourages the formation of fruit spurs on the larger limbs, and the trees can hold heavier crops without breaking than they can when most of the fruit is borne near the ends of the branches. Heading back the annual growth is not generally advised, as it results in stimulating growth near the cut and in a thickening of the growth near the ends of the branches, and consequently more shading in the interior. Severe pruning at the Northern Great Plains Field Station has in almost every case resulted in decreased yields without influencing to a marked degree the grade of the fruit. Varieties that tend to overbear, such as Opata and De Soto plums, may be pruned more severely, as this is one method of thinning the fruit. In most cases, however, it is better to thin fruit by hand at an early stage of development than to depend on severe pruning.

Interfering limbs, water sprouts, dead or broken limbs, and root sprouts should of course be removed from the bearing tree, and one of two branches forming sharp angles with each other should be removed or repressed by severe leading back. Keep the tree headed low and do not expose the trunk to sunscald by removing lower branches. If the tree has been properly pruned in earlier years, it will seldom be necessary to remove large limbs.

Pruning Wounds ⁵

As previously stated, large pruning wounds do not readily heal in the dry atmosphere of the Plains; hence they should be avoided as far as possible. In removing a branch care should be taken to cut it off close to and parallel with a larger limb or the trunk of the tree, as stubs do not readily heal over but remain bad places for rot fungi to gain entrance to the tree and weaken it or finally cause its death (fig. 19).



FIGURE 18.—Hyslop crab after pruning. This is the tree shown in figure 17.

⁵ For further information on pruning wounds, see Farmers' Bulletin 1896, Care of Damaged Shade Trees.

A dressing is desired that will disinfect the wound and protect it for several years from the entrance of fungi, but which will not injure the bark or interfere with healing processes. Rather thick

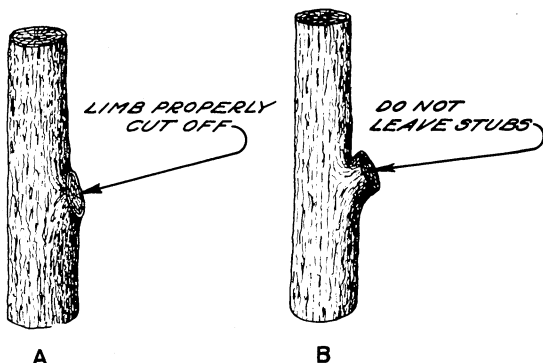


FIGURE 19.—A branch removed from a larger limb or the trunk of the tree should be cut off close, as shown in A. The stub left in B does not heal over readily, and rot fungi, other diseases, or borers may gain entrance to the wound.

white-lead paint is perhaps the most common substance used to protect pruning wounds. It should be mixed with raw linseed oil rather than turpentine, as the latter may injure the bark. The chief objections to paint are that it does not disinfect the wound and that it tends to crack and allow the entrance of wood-rot fungi if not renewed from time to time. Shellac, pitch, grafting wax, melted paraffin, and asphalt paints are other substances used to pro-

tect pruning or other wounds on trees. Of these, shellac is believed to be one of the best.

Trees injured by hail are pruned back severely and the damaged parts wrapped or painted to prevent excessive drying.

Season for Pruning

The early spring, just before growth starts, is ordinarily the best time to prune in the northern Great Plains. However, if there is evidence of severe winter injury, it is best to wait until after growth starts so that all dead branches may be readily detected and removed.

Tools for Pruning

A sharp pruning knife, hand shears, and sometimes long-handled pruning shears for larger branches are the only tools ordinarily needed for pruning. A pruning saw will also be found useful for removing dead limbs, or for trimming trees that have been neglected, but the saw should seldom be required on trees properly pruned from the beginning (fig. 20).

The pruning tools should be kept sharp and in good condition, as all cuts should be close, clean, and smooth.

PRUNING SMALL FRUITS

It is fully as essential to give small fruits a regular annual pruning as it is to prune tree fruits, if a high-grade product is desired.

Raspberries

The hill system of training raspberries is recommended for the northern Plains, where, except under irrigation, drought is the main limiting factor of crop production. Wires are often used to aid in

holding up the bushes, two wires about $1\frac{1}{2}$ feet apart being stretched about 3 feet high on either side of the row.

As soon as the crop is harvested all old canes should be cut out, as red-raspberry canes bear fruit only during the second season. Five or six of the best canes of the current season's growth may be left to the hill. These canes will fruit the following year. Some prefer to cut these selected canes back to about 3 feet in height, which encourages side shoots and does away with the necessity for a wire support.

Currants

Little pruning need be given currants for the first few years, except a light thinning out of the weaker shoots and branches. After the bushes become older, pruning is essentially a renewal process, old

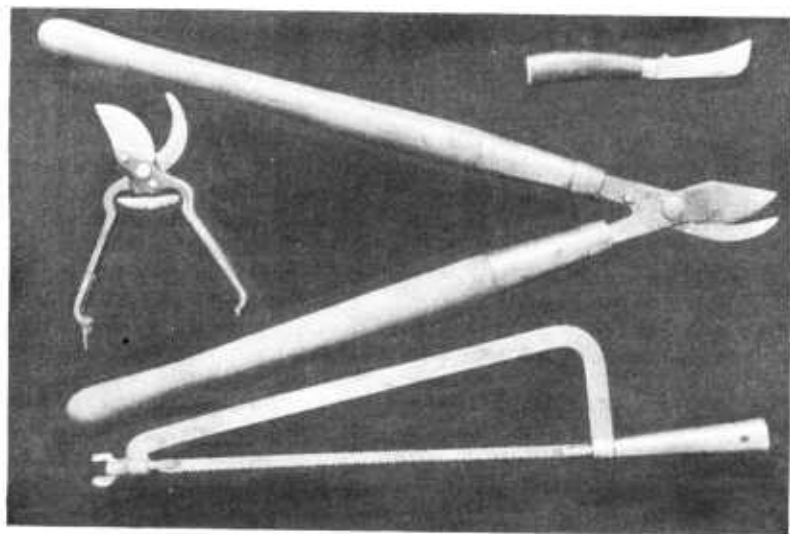


FIGURE 20.—Desirable types of pruning tools.

wood that has borne fruit for several years being removed and vigorous new wood selected to replace the old. All wood over 4 years old should be removed. No heading back or thinning out of individual branches is generally practiced, but the whole shoot is removed close to the ground after it becomes old and weak.

A good plan is to develop a bush with nine shoots, there being three 3-year-old, three 2-year-old, and three 1-year-old shoots left in the bush after each annual pruning. Each year the three oldest canes are removed and three of the most vigorous new shoots are selected to take their place.

Gooseberries

Pruning gooseberries is essentially a thinning out and renewal process as with currants, weak older wood being removed and vigorous new wood left for future fruiting. Individual branches of the gooseberry are sometimes thinned out if the growth is too thick, but there is not so much cutting out of shoots close to the ground as with currants.

Currants and gooseberries may be pruned either in the fall or in the spring, but late spring pruning is recommended, as wood killed during the winter can then be removed. The thick branches serve to protect one another to a certain extent and to hold snow during the winter.

Grapes

Grapes require a heavy annual pruning, as the fruit is borne on new wood of the current season's growth. Many different systems of pruning are used in training grapes, including the standard four-cane

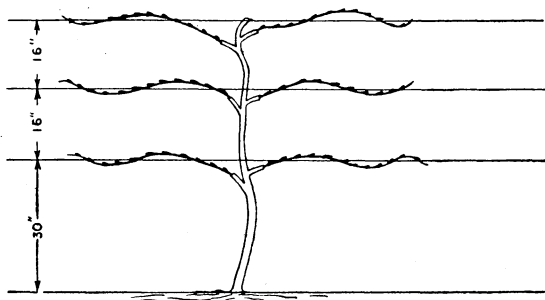


FIGURE 21.—Six-cane Kniffin system of pruning hardy grapes as advocated by the Minnesota Agricultural Experiment Station.

Kniffin method. Experimenters in Minnesota⁶ have found that a modification of this system to provide six fruiting canes, three on either side, on a three-wire trellis gives better results in Minnesota than the four-cane system (fig. 21). Their experiments show that a maximum of 20 to 25 feet of fruiting wood, or from 70 to 90 buds,

should be retained to give improved yield with very little decrease in berry size.

However, all varieties of grapes grown on the northern Plains benefit by being laid down and covered with soil during the winter, and the system illustrated by figure 22 has often been found to be advantageous under such conditions. With any system, superfluous canes are removed and the selected canes are cut back severely each year. The vines should be pruned late in October, just before being covered for winter.

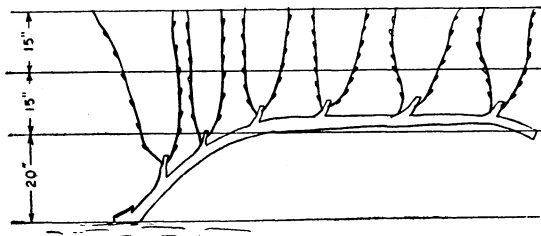


FIGURE 22.—A grapevine pruned to facilitate laying it down and covering it with soil for winter protection.

Native Fruits

Little is known concerning the pruning methods best suited for such native fruits as serviceberries (Juneberries), Bessey cherries, chokecherries, buffaloberries, and American cranberry bushes. Generally little or no pruning is done, and it is likely that a light thinning out where the growth is too thick is all that is necessary. Severe heading back or pruning of the lower limbs is not recommended.

⁶ BRIERLY, W. G., and ALDERMAN, W. H. GRAPE GROWING IN MINNESOTA. Minn. Agr. Expt. Sta. Bul. 297, 20 pp., illus. 1933.

Whenever tried, severe pruning has resulted in decidedly decreased yields at the Northern Great Plains Field Station.

THINNING FRUIT

The practice of thinning fruit is generally neglected, or sometimes it is done so late in the season that little benefit results. Yet it is very important that fruit trees on the northern Plains be not allowed to overbear, if they are to be kept in the vigorous vegetative condition desired. Overbearing results in small fruit of poor grade, large limbs



FIGURE 23.—Branches of a large-fruited variety of plum tree before the fruit was thinned.

broken by the weight of the crop, the individual fruits not well covered by sprays, and trees so weakened that they may be very susceptible to winter injury.

It is important to thin fruit early in the season, commonly just after the so-called June drop or natural thinning out of fruit that often occurs in early June. Plums should be thinned before the pits harden.

The details of thinning call for some knowledge of varieties, as the fruits of large-fruited varieties should be left farther apart on the limbs than the fruits of small-fruited varieties. Two branches of the same size might be strong enough to hold six Wealthy apples on the one hand or two dozen small crabs on the other. The fruit on weak branches that are liable to break should be thinned out more heavily than the fruit on strong branches. In general, apples may be thinned to 5 or 6 inches apart, crabs to 1 or 2 inches, large plums to 2 or 3 inches (figs. 23 and 24), and plum hybrids to about 1 inch apart. The

thinner should not follow any definite rule for distance, as that will vary with the distribution of the fruit, but he should thin sufficiently to prevent breakage of branches or overbearing, which weakens the tree.

Small fruits are not generally thinned.



FIGURE 24.—The same branches shown in figure 23 after the fruit was thinned.

CONTROL OF INSECTS AND DISEASES

Although not so troublesome as in most commercial fruit regions, insects and diseases in the northern Plains cause considerable damage both to fruit trees and the fresh fruits. Every fruit grower should be prepared to combat them.

Some form of arsenic, such as arsenate of lead, is commonly used to control insects which bite or chew the foliage or fruit. Codling moth (the insect responsible for wormy apples), caterpillars, and various beetles are examples of insects controlled by arsenical sprays. Plum curculios and plum gougers are two snout beetles, the larvae of which work inside of and spoil the fruit. They are partly controlled by spraying, both being rather difficult to poison. The gouger, probably the worst plum pest of the northern Plains area, passes the winter in the soil or under trash and starts to feed on the trees as soon as growth starts in the spring. Eggs are laid on the small fruits before the pits harden, and the larvae burrow into the fruit pits, where they pass the larval and pupal stages and finally work their way out of the fruit about the time it ripens. Early sprayings to poison the adults before they lay eggs are most effective. Late fall cultivation may destroy many of the hibernating adults in the soil.

Soft-bodied sucking insects, such as aphids or plant lice and young

leafhoppers, cannot be poisoned but may be controlled by a contact spray such as nicotine sulfate. Red mites or spiders are often troublesome in dry seasons, and effective control is difficult. The lime sulfur and nicotine are partially effective, but in a severe infestation some of the oil sprays combined with nicotine and fish-oil soap have given best results at the Northern Great Plains Field Station. Oil sprays must not be combined with lime sulfur.

Grasshoppers are one of the most troublesome of the Plains pests and sometimes strip trees of all foliage and even the tender bark. Poisoned-bran bait scattered in and around the orchard may be effective if spread in time, and if the grasshoppers are not too numerous.



FIGURE 25.—A plum borer killed by paradichlorobenzene treatment.

Plum borers are especially destructive to Japanese hybrid plums, but they also attack other plums and Bessey cherries. They work under the bark, near the ground, and may girdle the tree. Sawdust-like castings near the base of the tree usually reveal their presence. Paradichlorobenzene has been used with success at the Northern Great Plains Field Station in the control of this pest. About $\frac{3}{4}$ to 1 ounce of the crystals are scattered in a ring around the infested tree about 2 inches from its base, and the soil is then hilled up several inches around the tree trunk. Care should be taken that the crystals do not come in direct contact with the trunk of the tree, and it is not considered safe to use paradichlorobenzene on trees less than 5 years of age. Figure 25 shows a plum borer after being killed by the paradichlorobenzene treatment. The damage wrought by the borer may be seen in the picture. Another treatment, recommended by some but not tried at the Northern Great Plains Field Station, consists of

painting the bark in late fall, or before growth starts in the spring, with a compound consisting of 1 pound of paradichlorobenzene dissolved in 2 quarts of cottonseed oil.

Bordeaux mixture and lime-sulfur sprays are used as fungicides to control fungus diseases such as apple scab, brown rot, plum pockets, certain cankers, leaf spots, and fungus blights and wilts. To be effective in controlling plum pockets, the disease that causes the fruit to swell up to several times normal size, the fungicide should be applied at dormant strength (lime-sulfur, 1 gallon to 9 gallons of water) before growth starts in the spring.

Pear blight, or fire blight, a bacterial disease working inside the bark, cannot be controlled by spraying. Blighted limbs or cankers may be cut out considerably below the visible evidence of the disease and the cut branches burned. The cut surface and tools should be disinfected. Black knot of plums and chokecherries is another disease controlled by cutting out and burning infested branches.

Table 1 gives the time of application, common pests controlled, and the materials usually used for sprays at the Northern Great Plains Field Station.

TABLE 1.—*Spray schedule at the Northern Great Plains Field Station*

Spray	Time applied	Pests controlled	Materials used
First.....	Just before blossoms open.	Plum gougers, curculios, aphids, red spiders, caterpillars, plum pockets, and apple scab.	Lead arsenate (powder), ½ pound; lime-sulfur concentrate, 2½ quarts; nicotine sulfate (40 percent nicotine), 3 fluid ounces; water, 20 gallons.
Second.....	Shortly after petals fall...	Codling moth and pests mentioned under first spray.	
Third.....	Last week in June or first week in July.	do.....	
Fourth.....	Sometimes advised for the latter part of July but is not generally needed...		

As plums and apples require about the same schedules, it is generally practicable to spray them at the same time.

Small fruits may be sprayed along with the apples and plums, or whenever currant worms, caterpillars, or aphids are noticed on the bushes.

Young trees and bushes may not need spraying, but the farmer should be prepared to spray if insects start damaging the foliage.

A common horizontal type of barrel-pump sprayer, equipped with an agitator and 20 to 25 feet of hose, has been found convenient for the home fruit garden (fig. 26).

A fairly high pressure, at least 100 pounds, is desirable. Care should be taken to cover thoroughly all parts of the plant with the spray. The sprayer should be washed out and cleaned after each spraying.

PROTECTION FROM RABBITS AND MICE

It is likely that rabbits and mice, particularly the former, have killed a very large percentage of the apple and crab trees that have failed to survive on the northern Plains. Protection from these pests is even more important than spraying, at least for young trees.

If possible, the farm fruit garden should be enclosed with a rabbit-proof fence. If this is not practicable, it is advisable to wrap the trunk and larger branches of each tree with wood-veneer wrappers, heavy paper, burlap, cornstalks, or fine woven wire. This should be done before the first heavy snows of early winter, and the wrappers should remain on the trees until grass and vegetation start to grow in the spring.

If the snow is not drifting, it sometimes pays to shovel it away from the trunks of the trees, so that the rabbits cannot reach the higher, unprotected branches.



FIGURE 26.—Spraying a young orchard with a barrel-pump sprayer.

Poisoning also serves to keep rabbits in check. Poisoned corn, oats, alfalfa, and salt have been used at the Northern Great Plains Field Station with fair success. Directions for preparing poisoned oats, as furnished by the Fish and Wildlife Service, United States Department^t of the Interior, are as follows:

Mix 1 tablespoonful of starch in one-half cupful of cold water and stir into 1 pint of boiling water to make a thin clear paste. Mix 1 ounce of powdered strychnine with 1 ounce of powdered bicarbonate of soda (baking soda) and stir with the starch to a smooth creamy mass. Stir in 1 teacupful of table salt, apply to 12 quarts of good clean oats, and mix thoroughly to coat each kernel.

The above directions will serve for 12 quarts of corn instead of oats. The grain is distributed in small piles where rabbits feed.

Poisoned alfalfa leaves may also be used, directions by the Fish and Wildlife Service being as follows:

Dissolve 1 ounce of strychnine sulfate in 2 gallons of hot water and sprinkle over 10 pounds of alfalfa hay leaves. Mix the leaves thoroughly until all moisture is absorbed.

The poisoned leaves may be distributed in small handfuls in rabbit paths leading to the orchard and in the orchard itself.

Poisoned salt is effective in some cases. About 1 ounce of strychnine is mixed with 20 ounces of common salt and moistened enough to pack into 1-inch holes drilled half way through a 2- by 4-inch block of wood. The blocks are distributed in likely places where the rabbits run.

In handling poisons, care should be taken that they are kept out of the reach of children and that livestock are not poisoned.

Persistent shooting is one of the most effective methods of keeping rabbits in check. Also, various substances have been used on the bark of trees to act as repellents. Lime sulfur applied at the rate of 1 gallon of concentrate and 1 pound of glue to 9 gallons of water has been used with some success. A mixture of 5 parts of rosin and 1 part of linseed oil has been successfully used in Canada and in Michigan. The melted rosin and linseed oil mixture is applied warm with a brush, and a thin coating is said to protect the trees all winter. Other repellents include blood, axle grease, sulfonated oils, asphalt, lard, and various preparations on the market. Such repellents may be more or less effective, the difficulty being that most of them wear off in a few weeks and leave the trees unprotected. Some of them, such as sulfonated oil, may injure the trees under certain conditions and should not be used.

Mice sometimes build nests in straw or other material put around the tree for winter protection and may gnaw the bark and girdle the tree. Experience at the Northern Great Plains Field Station indicates that if the mulch is applied late in the fall or early in the winter after the ground is frozen and the mice have found their winter quarters there is not likely to be any trouble. However, mulch material should not be grain or hay bundles that have not been thrashed, as mice may be brought in with the bundles. If mice are present, the trees must be protected by wrappers of wood veneer or fine wire, or the mulch must be removed from close to the trunks. Mounds of dirt, 8 to 10 inches high, may be piled around the tree trunks and will serve to protect the trees. Poisoning may be resorted to, the poisoned oats being placed in tin cans at strategic places.

Severe pruning may be necessary for trees that have been damaged by rabbits or mice. Girdled limbs should be removed, and if the tree has been girdled, it may be necessary to cut off the entire top of the tree. In that event sprouts come from near the ground and are trained to form a new top. If the bark is eaten on only one side of a limb, the rough edges may be cut away and the damaged part wrapped with some material to reduce drying out, or the wound may be covered with grafting wax or other substance. Bridge grafting may be resorted to when the trunks of valuable trees have been girdled. This requires considerable skill, and those intending to try bridge grafting should read Farmers' Bulletin No. 1369 for full directions. The method consists in using live scions to bridge the girdled area, the ends of the scions being inserted under the healthy bark above and below where the damage took place.

SPECIAL WINTER PROTECTION

Some fruits require special winter protection on the northern Plains, and protection may also be desirable for other fruits during the first few winters after planting.

Strawberries should be covered with about 6 inches of clean straw just after the ground freezes. The straw may be removed in the spring after growth starts if clean cultivation is practiced, or it may be left as a mulch between the rows until after harvest. The latter method produces cleaner fruit and is effective if weeds do not become troublesome.

Raspberries and grapes, except the hardy native grape, should be completely covered with soil during the winter. They are covered just before the ground freezes in the fall, generally in late October, and are uncovered just before the buds start growth in the spring,



FIGURE 27.—Raspberry canes being bent over and tips held with soil in late fall. They are then completely covered to a depth of several inches.

generally about May 1. Care must be taken not to break the canes when they are bent over for covering. The canes are bent over and the tops held down with a shovelful of soil (fig. 27). The canes are then completely covered by shoveling soil on them. Some varieties of gooseberries, especially if growing in exposed locations, are benefited by being covered with soil.

The most difficult period with fruit trees is the first 2 years after planting. It often pays to give them special winter protection during this comparatively tender period. If the trunk and main branches are properly wrapped to prevent rabbit injury, such wrapping will also serve to lessen drying out and sunscald of the bark. A goodly number of cornstalks tied around each tree in late fall, with the tops sticking up through the branches, will help to protect the trees from both rabbits and wind.

The roots of young trees are often protected by piling soil, old manure, or partly rotted hay or straw around the trunks of the trees during the winter or by covering the entire fruit garden with 8 to 10 inches of straw or old hay. In either case the mulch is applied in late fall and removed before the trees start growth in early spring. The mulch aids in protecting the roots from winter injury but does not delay the time of bloom in the spring, as many persons think it does. As before stated, care must be taken that mice do not build nests in the mulch and damage the trees.

Sometimes a board is driven into the ground near each tree to shade the southwest side of the trunk in the afternoons of winter and early spring and thus prevent sunscald. Whitewashing the trunk and larger limbs also lessens the danger from sunscald, as the white surface remains cooler in the sunshine than would the darker bark. The whitewash is applied in early December and again in early March, warm days being chosen so that the whitewash will dry before freezing.

It is possible even to lay fruit trees down and entirely cover them with soil, but this involves considerable work if done carefully. If it is to be done, the trees should be planted in a slanting position to facilitate laying them down without breaking. It is doubtful if this method will ever become common.

KINDS AND VARIETIES OF FRUITS

Fruit growing on the northern Great Plains is restricted to the most hardy kinds and varieties. Such fruits as pears, peaches, apricots, quinces, cherries, blackberries, dewberries, and nuts are not generally hardy in this area, and except for a few new promising introductions their planting cannot be advised. Apples, crabs, plums, plum hybrids, Bessey cherries, serviceberries (Juneberries), grapes, currants, gooseberries, raspberries, and strawberries can be grown with a greater or less degree of success, depending on the district, the varieties chosen, the moisture supply, protection from wind, and the care given. Seedlings of hardy native fruits, including plums, serviceberries, Bessey cherries, golden currants, buffaloberries, and chokecherries, may be grown to advantage on the dry-land farm. Some of the native fruits, such as plums, buffaloberries, and chokecherries, may be used as outside or inside rows of the windbreak planting and there serve the dual purpose of providing shelter and producing some fruit. If plums are used in the windbreak they should be sprayed, so as not to harbor insect pests.

Plant breeders have made a great deal of progress in introducing new, improved varieties of fruits adapted to conditions on the Plains. As a result, the present list of recommended varieties is decidedly superior to a corresponding list of even 10 years ago, and much further improvement may be expected in the future.

A long period of trial under many different conditions is required to determine definitely the merits of a new variety. It is best for the grower to plant most of his ground to those standard varieties that have proved their merits under varying conditions for a number of years. Some room may be given to the newer sorts that appear to be promising but lack extensive tests.

It is well to select varieties that will supply fresh fruit for the table over a comparatively long period of time in the summer and fall.

By judicious selection fresh fruit can be picked almost continuously from the time strawberries begin to ripen in late June until the last apples are harvested in late October, or for a period of about 4 months of the year.

It is best to plant two or more varieties of each kind of fruit, as many varieties are self-sterile. In other words, pollen from some other variety of the same kind of fruit is required if the flowers are to be effectively fertilized and fruit is to set. This explains why trees of a single variety so often bloom profusely but fail to set fruit. The two varieties must bloom at about the same time, so that bees and other insects may carry pollen back and forth from one variety to the other. This is of greater importance with apples, crabs, plums, plum hybrids, golden currants, and Bessey cherries in which self-sterility is the rule, than with gooseberries, currants, grapes, and raspberries, which are generally self-fertile.

It is obviously impossible to give a list of fruits best suited to all parts of the northern Plains, as it is possible to grow some fruits at low elevations in the eastern part that would not mature at the higher altitudes nearer the Rocky Mountains or, perhaps, in the extreme northern part of the area. It is desirable for the farmer to write to his State agricultural college and to seek the advice of any neighbors who have succeeded in growing fruit, in order to determine which varieties are the safest for him to plant. The recommendations that follow are based on variety trials conducted at the Northern Great Plains Field Station and on observations made on the northern Plains.

APPLES AND CRABS

Apple production is uncertain on the northern Plains and should be attempted only where protection from wind is adequate. It is true that several varieties are hardy enough to survive the winter and early enough to ripen fruit in the comparatively short growing season. However, the fruit is often blown from the trees before reaching maturity, and rabbits seem to prefer the bark of apple trees to that of most other trees. Winter-killing, fire blight, and sunscald kill many apple trees even before they reach a bearing age. The latter is particularly severe on older trees following periods of drought. If apples are to be included in the home fruit garden, they should be given every possible protection and care. Many persons have succeeded with apples in towns where the trees are protected by buildings and where they can be watered, but there are fewer instances of success on farms.

Many apple and crab trees have failed to survive because of tender roots. The common French crab stock is not hardy enough for the northern Plains. Siberian crab (*Malus baccata*) seedlings have been most satisfactory as stock for apples and crabs at the Northern Great Plains Field Station. Seedlings of such hardy crabs as Florence or Dolgo may also be used for stocks, or hardy apple and crab varieties may be grown on their own roots.

Standard Varieties of Apples

The hardiest varieties of apples for the northern Plains are mostly of Russian origin. Brief comments on some standard varieties that appear to be best suited to the area are given below. The varieties

are arranged in order of ripening from the earliest to the latest. Any references to the time of ripening apply only to observations made at the Northern Great Plains Field Station, Mandan, N. Dak.

YELLOW TRANSPARENT.—This is a Russian apple and is of value because of its earliness. The fruit usually ripens about the middle of August, is medium to large in size, pale yellow, fair for either dessert or culinary uses, but not a good keeper. The trees are not thought to be so hardy or thrifty as some other Russian varieties and are somewhat subject to blight. However, in localities having a very short growing season this variety will ripen if any variety will.



FIGURE 28.—Young Anoka apple tree, bearing fruit, at the Northern Great Plains Field Station.

CHARLAMOFF.—This Russian variety has been outstanding in parts of the northern Plains area and has failed in other parts. It has a very good record in Canada. Charlamoff ripens a little before Oldenburg, which variety it resembles. Although tart, it is of good eating quality when at its best. It is a poor keeper.

OLDENBURG.—This apple, commonly known in the Northwest as Duehess, is one of the most widely planted of the Russian varieties. The fruit usually ripens in the latter part of August, is medium to large in size, striped with red, pleasantly subacid, fair for dessert, and good for culinary uses, but is not a good keeper. The tree comes into bearing at an early age, is hardy and productive for an apple, but is not considered very long-lived. Oldenburg should be included in the home fruit garden wherever apples are grown on the northern Plains. A variety known as Red Duehess originated as a bud sport of the Oldenburg. It is similar to the latter except more attractive in color.

ERICKSON.—The Erickson, a large red apple, originated in Minnesota and is probably of Russian parentage. It ripens in the latter part of August, the season

being about the same as that of Oldenburg. Erickson is useful either for dessert or culinary uses, and the tree has been hardy and fairly productive.

ANOKA.—Anoka has the unusual quality of bearing fruit from lateral buds on 1-year wood as well as spurs, and it comes into bearing at an earlier age than other varieties. The fruit is striped with red, but not so well colored as Oldenburg, and is of fair quality for dessert or culinary uses. The tree has been hardy and prolific (fig. 28), but it is not considered very long-lived.



FIGURE 29.—Harvesting Hibernial apples at the Northern Great Plains Field Station.

WEALTHY.—This seedling of Cherry crab originated in Minnesota and is one of the best dessert apples that can be grown on the northern Plains, though it is not so hardy as some of the Russian varieties. The fruit generally ripens from the first to the middle of September, is medium to large in size, striped and splashed with red, juicy, agreeably subacid, and good for either dessert or culinary uses. It keeps better than Oldenburg. The tree is not so hardy as could be wished, but fruits at a fairly early age and is generally productive.

PATTEN.—Patten, a seedling of Oldenburg, originated in Iowa and resembles its parent in some fruit and tree characteristics. The fruit generally ripens in the middle of September, is medium to large in size, green in color, subacid, fair for dessert, and good for culinary uses. This variety is one of the hardiest of the apples, and the trees are generally productive.

HIBERNAL.—This Russian variety is perhaps the hardiest apple of them all. The fruit generally ripens about the middle of September, is large, striped with red (often only on one side), subacid, astringent, too sour for dessert, but fair for culinary uses. The tree will grow if apples will grow at all, is generally productive, and makes an unusually strong framework suitable for top working other varieties (fig. 29).

HARALSON.—Haralson generally ripens in the latter part of September. It is the best keeper that is reasonably hardy on the northern Plains, its season lasting until spring. It is red, although not so attractively colored as Wealthy, which it somewhat resembles in size and shape, and is of good quality for eating out of hand or for culinary uses. The tree is strong and vigorous.

LONGFIELD.—This Russian variety also ripens in the latter part of September. The fruit is below medium in size, but of good quality for dessert or culinary uses. The keeping quality is only fair. It is greenish yellow, lightly blushed with red. The tree has been hardy and fairly productive.

OTHER VARIETIES.—Antonovka, Okabena, and Anisette are three other varieties that have done fairly well at the Northern Great Plains Field Station, or elsewhere on the northern Plains. Mantet, Waukon, Melba, Mortoff, and Beacon are newer varieties considered worthy of trial.



FIGURE 30.—Florence crab, bearing fruit. This variety has been the most prolific of all varieties under test.

Standard Varieties of Crabs

SILVIA.—Silvia ripens in early August and is the earliest of all crabs under test. Therefore it should be of value in sections having the shortest growing seasons. The fruit is yellow, of medium size, and of fair quality, if picked a little on the green side, as it becomes mealy if too ripe. Silvia is good for either pickles or jelly but is a poor keeper. The tree is hardy, upright, and resistant to blight.

SWEET RusSET.—The Sweet Russet crab matures in mid-August. The fruit is large, oblong, and greenish yellow marked with russet. It is good for eating out of hand or for pickles. The tree has been fairly hardy and generally bears a fair crop.

FLORENCE.—This crab generally ripens in the latter part of August. The fruit is medium to large in size, oblate, striped, and splashed with bright red, very attractive, subacid, somewhat astringent but good for culinary uses. It becomes mealy if too ripe. This variety did not seem to be so hardy as Transcendent or Virginia in the early years of the station but has been hardy and drought-resistant of late years. It is very resistant to blight and starts bearing at an early age. The blossoms seem to be able to withstand late spring frosts better than those of most varieties, and it has been the most prolific and reliable bearer under test. This variety is highly recommended for the home fruit garden (fig. 30).

WHITNEY.—Whitney ripens about the same time as Florence. The fruit is large for a crab, light yellow, shaded and striped with red, mildly subacid, and good for either dessert or culinary uses. The tree has been fairly hardy but has been a shy bearer at the Northern Great Plains Field Station (fig. 31).



FIGURE 31.—Row of Virginia crabs at left and Whitney crabs at right, showing the greater vigor and more prolific bloom of the Virginia. Northern Great Plains Field Station.

DOLGO.—Dolgo also ripens in the latter part of August. The fruit is small, oblong or oval, attractive bright red, juicy, tart, and excellent for making jelly. The tree is upright, hardy, and prolific. This is considered one of the most valuable varieties for the northern Plains.

ALEXIS.—The Alexis crab is very similar to Dolgo, and what has been said about Dolgo applies to Alexis.

TRANSCENDENT.—Transcendent generally ripens in early September. The fruit is medium to large for a crab, attractive yellow and red when ripe, round in form, subacid, somewhat astringent but good for culinary uses. The tree is usually thrifty, hardy, and productive on the northern Plains. The worst fault of Transcendent is its susceptibility to blight, and for this reason its planting cannot be recommended in districts where blight is known to be troublesome.

ROBIN.—Robin is a Canadian introduction that has done very well at the Northern Great Plains Field Station. It generally ripens early in September. The fruit is medium size, firm, juicy, subacid, yellow with slight red blush, and is desirable either for jelly or pickles. The tree is spreading in habit of growth, and has been blight-resistant, fairly hardy, and prolific.

AMUR.—Amur generally ripens before the middle of September. The fruit is small, slightly oblate, attractive bright red, firm, juicy, tart, and excellent for jelly. The tree is upright, vigorous, resistant to blight, very hardy, and generally productive.

COLUMBIA.—A Canadian introduction, Columbia matures before or about the middle of September. The fruit is small to medium in size, conical, red when ripe, juicy, tart, and good for jelly and other culinary uses. The tree is vigorous, hardy, blight-resistant, and generally productive.

VIRGINIA.—This variety ripens a little late for the northern Plains, but it has so many desirable characters that it is recommended for the home fruit garden except in districts having unusually short growing seasons. Virginia ripens from the middle to the latter part of September at the Northern Great Plains Field Station. The fruit is large, blushed, and striped with red, attractive, pleasantly subacid, juicy, fair for dessert, and good for culinary uses, especially for pickles. The tree is harder than most varieties, a thrifty grower, and the limbs are strongly attached to the tree (fig. 31).

OTHER VARIETIES.—Among newer varieties thought to be worthy of trial are Trail and Rosilda, large-fruited Canadian introductions; Flame, a fine jelly crab from Minnesota; and Red River, a cross between Dolgo and Delicious, introduced by the North Dakota Agricultural Experiment Station.

PLUMS AND HYBRIDS

Plums and plum hybrids are the most reliable tree fruits for the northern Plains and should form a considerable part of the home fruit garden. Varieties may be selected that will extend the harvest season from the time Opata and Tecumseh ripen—generally before the middle of August at Mandan, N. Dak.—until Emerald is picked, which is generally about the middle of September. The season is more restricted in districts having a shorter frost-free period.

Hardy native plum seedlings are thought to make the best stocks for plums in this area. Sand cherry (*Prunus pumila*) and Bessey cherry (*P. besseyi*) seedlings also have been used successfully as hardy stocks for plums, but the sand-cherry root suckers badly, the tree is liable to become top-heavy and blow over, and there is some evidence that these roots may result in a shorter lived tree. On the other hand, there is no difficulty in determining whether shoots are from the root or the scion, as the foliage of the sand cherry is very different from that of the plum. The sand-cherry root does well in sandy soils.

Plums recommended for the northern Plains area may be divided into three general groups, namely, native plums (mostly *Prunus americana* or *P. nigra* selections), hybrids between native and Japanese (*P. salicina*) plums, and hybrids between either native or Japanese plums and the native Bessey cherries (*P. besseyi*).

Native Plums

Native plum varieties have long been considered the most reliable tree fruits for the plains and prairies of both the United States and Canada. As a group they possess unusual hardiness and drought resistance for fruit trees, they are prolific bearers, and the fruit is acceptable for dessert and culinary uses. They are not, however, first-class for either purpose, as they are characterized by a tough sour skin and considerable sourness near the pit, especially when cooked. A few native plums should be included in every home orchard because of their hardiness and fruitfulness and also because they generally furnish an abundance of pollen for cross-pollination purposes, whereas the hybrids are often deficient in pollen production.

Standard varieties of native plums that have been grown successfully at the Northern Great Plains Field Station are listed in their order of ripening. As with apples and crabs, the time of ripening given is for Mandan and vicinity and will vary to some extent in different parts of the northern Plains. Also, the time of ripening given

represents an average time. The ripening date of a variety may vary as much as 2 weeks before or 2 weeks after the time given.

ASSINIBOIN.—This is probably the best variety of *Prunus nigra* under test at the Northern Great Plains Field Station. It generally ripens in late August. The fruit is large, red, sweet, juicy, and of good quality for a native. The tree is fairly hardy but not a strong grower or a heavy yielder. Like other *nigra* varieties this plum will probably do best in the northern part of the area and where the seasons are short.

CHENEY.—Cheney generally ripens late in August or early in September. The fruit is medium size, red, juicy, and of fair quality. The tree is fairly hardy but has not been a heavy yielder at the Northern Great Plains Field Station. It blooms early, thus being subject to damage from late-spring frosts. Cheney is reported to be among the best varieties on the Canadian prairies and did well in tests in Wyoming; it may therefore have a place in parts of the northern Plains, but the results of tests at Mandan are not so favorable as with some other varieties.

WOLF.—Wolf also ripens in late August or in early September. The fruit is small to medium in size, dull red, freestone, and of good quality for a native plum. The tree is generally hardy, fairly productive, and is one of the best of the old standard varieties.

TERRY.—Terry generally ripens in early September. It is one of the largest of the American plums, an attractive red and yellow when ripe, firm fleshed, clingstone, and of good quality for its group. Young Terry trees have not been so hardy as other Americana varieties at the Northern Great Plains Field Station, but of late years bearing trees have been fairly hardy and prolific. The variety seems to be very subject to aphid attack. However, because of the size and quality of the fruit, Terry is considered one of the best of the Americana plums.

WYANT.—Wyant ripens about the middle of September. The fruit is small to medium in size, yellow blotched with red, nearly freestone, and of fair quality. The tree is one of the hardiest of its class, is a prolific annual bearer, and produces an abundance of pollen for cross-pollination purposes. The fruit is not so good as that of some other varieties, but the hardiness of the tree and its heavy bearing habits recommend it for a place in the home fruit garden, probably above varieties of better quality, like Surprise, which tend to be unfruitful.

DESOTO.—Desoto usually ripens about the middle of September. The fruit is small, yellow with red cheek, clingstone, and of good quality for an Americana plum. The trees tend to overbear and have not been so hardy or thrifty as Wyant and Wolf at the Northern Great Plains Field Station.

Brief descriptions of some of the promising newer varieties of native plums follow.

MANDAN SELECTION 75.—This selection usually ripens from the middle to the latter part of August. The fruit resembles De-soto, is sweet, juicy, and of fair quality. The tree is a strong grower and very hardy. Because of its earliness, this selection is thought to be of value in districts where the fruit of such varieties as Wolf or Terry is in danger of being damaged by early fall frosts.

MANDAN SELECTION 73.—This plum was found growing in an orchard near the Northern Great Plains Field Station. It is believed to be from the seedling root, as it has not been identified as any named variety. It ripens early in September. The fruit is large, attractive red, clingstone, sweet, and of good quality. The tree appears to be hardy and a reliable annual bearer, but it has some tendency to form acute angled crotches that easily split. It is earlier than most Americana varieties, and because of its size and quality is thought to be worthy of trial.

MANDAN SELECTION 48.—This selection generally ripens around the first of September. The fruit is large, attractive red, juicy, sweet, and of good quality for a native. The tree is hardy, productive, and has a strong framework. This plum is considered one of the best native varieties.

WASTESA.—Wastesa generally ripens in the first part of September. The fruit is mottled red, juicy, sweet, and of good quality. The trees have been hardy and prolific.

TETON.—Teton ripens about the middle of September or a little earlier, is of medium to large size, red, sweet, clingstone, and of fair dessert quality for a native plum. The trees have been among the hardiest plums tested at the Northern Great Plains Field Station, are thrifty growers, prolific yielders, and abundant pollen producers. The fruit drops badly when ripe, and the trees have some tendency to split. However, it is deemed worthy of trial.

Japanese Hybrid Plums

Of late years Japanese hybrid plums have largely replaced native varieties in the nursery trade of the Northwest. This has been due to their large size, small pit, attractive appearance, and superior quality as compared to native varieties. However, the native \times Japanese plums are not generally so hardy or prolific as native varieties, nor do they produce much pollen. For these reasons it would seem best not to discard the native varieties, but to grow some of each class in the home garden.

Some of the better Japanese hybrid plums are briefly described below in their order of ripening.

TECUMSEH.—This plum ripens in early August and is among the earliest under test. It is of large size, has an attractive bright red color and thin skin; is firm, sweet, juicy, and good either for dessert or culinary purposes. The tree has been moderately hardy and fairly prolific.

RADISSON.—This fine early plum generally ripens about the middle of August. The fruit is large, attractive red, with light colored dots, sweet, firm, juicy, and of excellent quality. It blooms early, thus being subject to injury from late spring frosts. The tree has been moderately hardy, but it has not been a heavy yielder at the Northern Great Plains Field Station.

PEMBINA.—Pembina also matures around the middle of August. The fruit is large, deep red, and of superior quality. The tree has been fairly hardy, but it blooms early, and yields have been uncertain. It seems to thrive best toward the northern part of the area and in districts requiring an early maturing variety.

CREE.—Cree is one of the hardiest and most prolific of the Japanese hybrids. The average ripening date is around August 15 or a little later. The fruit is of medium size, red, clingstone, sweet, thick skin, and fair quality. This variety approaches nearer to the native type than most Japanese hybrids. It is of value in the more severe sections of the northern Plains, on account of its earliness, hardiness, and productiveness.

UNDERWOOD.—Underwood ripens from the middle to the latter part of August. This is a large red plum of good quality. The tree has been moderately hardy, but not very productive at the Northern Great Plains Field Station.

LA CRESCENT.—La Crescent ripens about the same time as Underwood. It is a yellow plum of medium size, thin skin, sweet, and excellent for eating out of hand or for sauce. It probably rates the highest quality of any plum under test. Young trees killed back considerably, but the older trees have been fairly hardy. It has been an erratic bearer.

TOKATA.—Tokata also ripens in the latter part of August. The fruit is very large, a mottled orange red in color, very firm, and of excellent quality either for dessert or culinary uses. Like Hanska and Kaga, it inherits from one parent the rich flavor of *Prunus simonii*, or the apricot plum of China. The tree has been reasonably hardy, but this variety has been a shy bearer at the Northern Great Plains Field Station. It is recommended only for the most favorable districts of the northern Plains area.

RED WING.—Red Wing is an excellent plum that ripens in the latter part of August. The fruit is very large, freestone, mottled bright red, and of very good quality either for dessert or culinary uses. The tree has been moderately hardy and generally productive. This is one of the best plums for well-protected sites.

OJIBWA.—Ojibwa generally ripens in the latter part of August, or sometimes in the first part of September. It is of medium size and becomes bright red considerably before it ripens. The firm flesh, thin skin, and pleasant flavor make this variety excellent for culinary uses. The tree has been moderately hardy and productive.

WANETA.—Waneta is one of the largest of the hybrid plums and is generally very prolific. The fruit ripens in early September, is deep red in color, clingstone, firm, and of fair quality for dessert and good for culinary uses. The tree is moderately hardy but sometimes tends to overbear. This variety should be especially useful in the southern part of the area and in sheltered places.

HANSKA AND KAGA.—The fruits of these varieties are very much alike, both ripening in early September and being of medium size, firm fleshed, and delightfully flavored by the *Prunus simonii*, or apricot plum, used as one of the parents. The trees have suffered considerable drought injury, and fruit production has

been erratic. Hanska is the taller growing, more vigorous tree. Otherwise there is little to choose between the two. These varieties are recommended only for well-sheltered sites.

EMBER.—Ember is a recently named variety that ripens in early September. The fruit is large, mottled red and yellow, firm of flesh, and of good quality either for dessert or canning. The tree has been moderately hardy and productive. This fine plum is recommended for sheltered sites in the southern and eastern parts of the northern Plains area. It is probably too late for sections having a short growing season.

ELLIOT.—Elliot generally ripens from the first to the middle of September. The fruit is large, attractive red, firm, a good keeper, and especially desirable for culinary uses. The tree has been one of the hardiest of the Japanese hybrids and a good yielder. This variety is recommended as a late plum in districts where it will ripen before frost.

MONITOR.—Monitor also ripens from the first to the middle of September. The fruit is very large, bronze red, with conspicuous russet spots, elingstone, rather tart skin and tart around the pit, but good for dessert or culinary purposes. The tree has been moderately hardy and a fair yielder. Monitor is also recommended for sheltered sites in districts of the area having the longest frost-free period.



FIGURE 32.—Part of the plum-variety-testing orchard at the Northern Great Plains Field Station showing plum \times sand-cherry hybrids and their characteristic bush form.

EMERALD, BURWOOD, OMAHA, AND WINONA.—These varieties all ripen in the middle of September, making them too late to mature their fruits in much of the northern Plains area. They are large, dull mottled red and yellow, very sweet and juicy, and excellent for dessert or culinary uses. They are not good keepers. The trees have ranked among the hardiest of the Japanese hybrids, and they have been productive as a general rule. They are recommended for parts of the northern Plains having the longest growing season.

OTHER VARIETIES.—Newer Japanese hybrid varieties that have shown promise at the Northern Great Plains Field Station include Minnesota 62, a large, bright-red plum ripening at the same time as Teeunseh; Minnesota 133, a very large, mottled red and yellow plum of high quality, which ripens in the first part of August; Minnesota 17, a medium-to-large, red, freestone plum of high quality, ripening in the latter part of August; and Minnesota 103, a large, firm, mottled red plum of good quality, which ripens in early September. These are considered worthy of trial.

Plum Hybrids

Crosses between plums and Bessey cherries (*Prunus besseyi*) have resulted in some plum hybrids of great value for the northern Great Plains area. The trees tend to bear at an early age, are generally prolific, hold the fruit firmly, so that it is not easily blown off, and

bloom late, thus tending to escape late spring frosts. They generally ripen their fruit early in the season, are drought-resistant, and suffer very little from attacks of aphids. These hybrids are generally superior to native plums for culinary uses, as they have a tenderer skin, a smaller pit, and considerably less of the objectionable sourness of native plums when cooked. Some varieties come nearer to taking the place of the cherry than anything else at present in the nursery trade.

Objections to this plum-hybrid group are that the trees tend to be short lived and generally produce but little pollen, the fruit is usually of small size and as a rule keeps poorly. Trees in this group should be grown in bush form only (fig. 32).



FIGURE 33.—Opata plum growing in bush form at the Northern Great Plains Field Station. This plum \times sand-cherry hybrid is one of the most valuable varieties for the northern Plains.

Standard varieties of plum \times sand-cherry hybrids are briefly described below in their order of ripening.

OKA.—Oka ripens in early August. The fruit is small to medium in size, dark-blue skin, red flesh, small pit, sweet, juicy, and good in quality. The tree is not so hardy or prolific as Opata. This variety is recommended for the most sheltered locations.

OPATA.—Opata is one of the earliest plum hybrids, generally ripening in the first part of August at Mandan. The fruit is small to medium in size, deep-blue skin, green flesh, small pit, clingstone, of only fair dessert quality, but good for culinary purposes. The tree is drought-resistant, fairly hardy, and very prolific, often tending to overbear. It is recommended for every home fruit garden (fig. 33).

SAPA.—Sapa ripens in the latter part of August, generally about 9 or 10 days after Opata. It is of about the same size and skin color as Opata, but has a dark-red or black flesh and is of very good quality. It is especially valuable for culinary uses, where it takes the place of the cherry in pies and sauce. The tree is not so

hardy as Opata or so reliable a bearer, but, because of the superior quality of the fruit, it is recommended for the more favorable districts and well protected sites (fig. 34).



FIGURE 34.—Sapa plums in the foreground, badly killed back in the winter of 1924-25, whereas Opatas in the row to the left escaped injury.

COMPASS.—Compass usually ripens in late August. The fruit is small, red and yellow, elingstone, of only fair dessert quality, but good for culinary uses. Compass will probably stand up and bear fruit under as severe conditions as any variety. The tree is very hardy, drought-resistant, and a heavy annual bearer. A few trees of this variety should always be included in the home fruit garden (fig. 35).

ZUMBRA.—Zumbra ripens about the same time as Compass. The fruit is small to medium, dark-blue skin, green flesh, sweet, and especially good for culinary uses. The tree has been fairly hardy, but this variety has not been a heavy yielder at Mandan. It is recommended for trial in the more favorable districts.



FIGURE 35.—Compass, one of the hardiest and most prolific of the plum \times sand-cherry hybrids.

OTHER VARIETIES.—Mordena and Cooper are two new plum hybrids that have not been under test at Mandan long enough to draw conclusions as to their value. However, they have done well at other places and are recommended for trial.

CHERRIES

None of the common varieties of cherries in the nursery trade is hardy enough for general planting on the northern Plains. Success is occasionally obtained, in unusually well-protected sites in the most favorable districts, with such varieties as Early Richmond, Dyehouse, or Wragg, but cherries cannot be generally recommended for this area.

Selections of the Nanking cherry (*Prunus tomentosa*) and of hardy Russian cherries from the Vladimir district appear very promising as hardy cherries for the future, but few named varieties are on the market at present.

The Dominion Experiment Station at Morden, Manitoba, Canada, has recently introduced Drilea, a variety of the Nanking cherry, and Coronation, a Shubianka sour cherry seedling. Both are deemed worthy of trial in sheltered locations.

APRICOTS

Plant breeders have made considerable progress in developing hardy apricots during the past few years. The South Dakota Agricultural Experiment Station has named several seedlings of the Manchurian apricot, and the Dominion Experiment Station at Morden, Manitoba, has introduced the Scout apricot. The Siberian apricot has also been crossed with standard varieties at the North Dakota Agricultural College and the Northern Great Plains Field Station. Some of these new introductions are thought to be worthy of trial in sheltered locations, as they are drought-resistant and reasonably hardy. They should be propagated on Manchurian or Siberian apricot roots, as the apricot does not form a good union with the plum.

GRAPES

Most standard varieties of grapes lack the hardiness to thrive on the northern Plains. A few varieties, however, do well in the more favorable sections, especially if laid down and covered with soil during the winter. Such protection has more than doubled yields of grapes at the Northern Great Plains Field Station.

Beta is the standard variety for the area and will thrive if any variety will. The fruit is smaller and more tart than Concord but is very acceptable for jelly and other culinary uses. Alpha, Suelter, and Dakota are similar to Beta and have done fairly well at Mandan. Monitor ripens earlier than Beta but has not been so prolific.

Several newer varieties have been introduced by the Minnesota and South Dakota Agricultural Experiment Stations, some of which are superior in size and quality to Beta. However, these better varieties, as a general rule, have been less hardy and less productive than Beta.

Native grapes are sometimes planted and are hardy without winter protection. The fruit is small and sour but acceptable for jelly.

SMALL FRUITS

Such small fruits as currants and gooseberries are among the most valuable for the northern Plains. They should be included in every home fruit garden.

Currant varieties that have done well at the Northern Great Plains Field Station include London Market, Red Dutch, Perfection, Red Lake, and White Grape. The first two are red currants that have been very hardy and are heavy annual bearers. Another red variety, Perfection, has not been so hardy or prolific as the others mentioned, but the berries and clusters are large and easy to pick. Red Lake is a new, large-fruited variety of good quality. It has been more prolific than Perfection. White Grape may be added if a white variety is desired. Figure 36 shows London Market currants apparently uninjured after the winter of 1924-25, whereas Cherry currants in an adjacent row were killed back almost to the ground.



FIGURE 36.—London Market currants at the left, uninjured in the winter of 1924-25, at the Northern Great Plains Field Station, and Cherry currants at the right, killed almost to the ground.

European black currant (*Ribes nigrum*) varieties are not recommended, because they are extremely susceptible hosts for white pine blister rust.⁷ In Montana it is unlawful to possess or sell these plants, and the United States Department of Agriculture is opposed to their being grown anywhere in the United States, as they constitute a menace to the white pine forests.

Gooseberries have not been so hardy as currants during severe winters but have shown greater ability to endure summer drought. They are one of the most valuable fruits for the home fruit garden.

⁷ All currant and gooseberry (*ribes*) plants are hosts of white pine blister rust, a destructive disease of 5-leaved pines. The invasion of North America by the white pine blister rust has brought about laws and quarantines prohibiting or regulating the shipment of currant and gooseberry plants, in order to control the disease. For this reason persons desiring to ship currant and gooseberry plants should consult the State nursery inspector as to legal restrictions.

Houghton, Carrie, and Pixwell have been among the hardiest and most prolific varieties under test and are recommended for general planting. Houghton is a red variety of small size but good quality. It has been very hardy and prolific (fig. 37).

The Carrie gooseberry is similar to Houghton in color, size, and quality. It is among the hardiest, is generally prolific, and is easy to pick because of its relative freedom from thorns and because of the position of the berries (fig. 38).



FIGURE 37.—Oregon gooseberries, at the right, killed back to the ground in the winter of 1924-25, and Houghton gooseberries, at the left, uninjured.

Pixwell, a medium-sized green variety introduced by the North Dakota Agricultural Experiment Station, is fast becoming the most popular variety in the area. It has been hardy, drought-resistant, and prolific. The bush is a vigorous grower, and the berries hang down on long stems, so they are easy to pick.

The Oregon variety has not been hardy at Mandan. It is a large green gooseberry, rather sour but of fair to good quality, and is suggested for trial under favorable conditions. Figure 38 shows Oregon gooseberries killed to the ground in the winter of 1924-25, when Houghton gooseberries in an adjacent row were not injured.

Abundance, Perry, and Kataga are three new varieties considered worthy of trial. They have been hardy and drought-resistant.

Raspberries are neither hardy nor drought-resistant enough to be adapted for general planting in the dry-land fruit gardens of the northern Plains. If grown, they should be covered with soil in the winter and if possible irrigated. Loudon, King, Herbert, Latham, Chief, Newburgh, Ohta, and Sunbeam have yielded light crops at the Northern Great Plains Field Station in favorable years, but all varieties have failed in dry years, and most of the plants died in the

drought of 1936. Sunbeam is one of the hardiest and most drought-resistant, but the fruit is small. Latham, when covered during the winter, has been the highest yielder and has produced the largest fruit. Chief has been fairly hardy and has produced fair crops of good fruit. Cumberland has been the hardiest and most drought-resistant black raspberry under test. It has produced fair crops and has survived the drought better than any of the red varieties. Sodus, a new



FIGURE 38.—A 3-year-old Carrie gooseberry loaded with fruit at the Northern Great Plains Field Station.

purple variety, has done well in preliminary tests and is considered worthy of trial.

Dewberries are not generally recommended, but the variety Lucretia survived the drought better than most raspberries and has produced light crops of fruit.

Strawberries do well in the home fruit garden if irrigated and properly protected with a straw mulch during the winter. If water is not available, it is doubtful if they have a place there, as the crop is often a failure under dry-land conditions. Dunlap, Premier, and Dakota have been the best yielders of the June-bearing varieties tested, and Dorsett and Fairfax are suggested for trial. Progressive, Duluth, and Mastodon are three everbearing varieties that have done fairly well, and Wayzata is suggested for trial.

NATIVE FRUITS

A number of hardy native fruits are to be found in protected coulees and along streams throughout a large part of the northern Plains area. People often drive long distances to pick such fruits and

occasionally transplant young bushes from the wild to their yards or grow seedlings from particularly good wild plants.

Plums are of first importance among the native fruits, *Prunus americana* being the species common on the northern Plains. Named varieties of native plums have already been discussed (p. 41). The wild fruit is used for canning, jam, sauce, plum butter, jelly, and for eating out of hand.

The Bessey cherry or western sand cherry (*Prunus besseyi*) is not gathered so much in the wild as are some other native fruits. It seems to respond very readily to cultivation, both fruit and bush becoming much larger than they are ordinarily found in the wild state.



FIGURE 39.—Native Bessey cherry (*Prunus besseyi*) selection at the Northern Great Plains Field Station.

Several varieties have been named, of which Sioux, Champa, and Brooks have been the best of those tested at the Northern Great Plains Field Station. These varieties have been hardy, drought-resistant, and usually prolific, so they are of value for the home fruit garden. Sioux ripens earlier than any plum, is sweet and mild in flavor, and is good for pies or sauce. Champa may have some plum blood in it and belong in the plum-hybrid class, but it is a dwarf bush and so may be treated as a Bessey cherry. It appears to be hardy and prolific. Brooks is a newer introduction from Canada. The fruit is large, firm, and good. Figure 39 shows a fruiting branch of a Bessey cherry selection.

The common wild chokecherry (*Prunus demissa* var. *melanocarpa*) is much sought after in the wild state because of the excellent jelly and wine which this fruit makes. Some so-called chokeless selections have been made and have had a limited sale on the market, but there are

few, if any, named varieties of this fruit. Chokecherries may be used for an outside or inside row of the shelterbelt and may thus furnish both fruit and shelter. Figure 40 illustrates fruiting branches of the native chokecherry and shows its heavy production.

Native buffaloberries (*Lepargyrea argentea*) also make good jelly, although it is of light color and not so clear as some other fruit jellies. These berries are frequently gathered in the wild, being knocked from the trees onto blankets spread to catch them. But little work has been done to improve the buffaloberry, and few are grown under



FIGURE 40.—Native chokecherry (*Prunus demissa* var. *melanocarpa*) selection at the Northern Great Plains Field Station.

cultivation for the fruit. Like the chokecherry and the plum, it may be used for an outside or inside row of the shelterbelt, where it will be of use for both shelter and fruit.

Juneberries, also called serviceberries, saskatoons, and shadblows (*Amelanchier alnifolia*, *A. alnifolia pumila*, and *A. canadensis*) are native to the region and are often gathered from wild plants, the fruit being used for pies and sauce. The flavor is a little flat; hence currants or rhubarb are usually mixed with Juneberries with very good results. The only named variety of Juneberry tested at the Northern Great Plains Field Station is Success. It is of fair size and quality, hardy, and generally prolific. It has done very well and deserves a place in the home fruit garden. Selection and breeding work with Juneberries is in progress at the station.

The fruit of the native American cranberrybush (*Viburnum americanum*) is desirable for jelly. Some superior selections of this fruit have been made by Mrs. Fanny Heath, of Grand Forks, N. Dak., and

by the North Dakota Agricultural Experiment Station. However, this fruit lacks the ability to withstand prolonged periods of drought, and is only recommended for the more favorable sections of the northern Plains, or in places where it is possible to irrigate.

Golden or yellow flowering currants (*Ribes odoratum*) (fig. 41) are sometimes picked in the wild and are grown for fruit and ornamental purposes. They make very good jelly and jam, and some persons like them in pies. A number of promising selections have been made at



FIGURE 41.—Native golden currant (*Ribes odoratum*) selection at the Northern Great Plains Field Station.

the Northern Great Plains Field Station, and the best of these are thought to be well worth planting in the home fruit garden of the northern Plains. They are very hardy, drought-resistant, and reliable yielders. An objection is the uneven ripening of the fruit.

Among other native fruits may be mentioned the American black currant (*Ribes americanum*), which is useful for jelly or jam; the native grape (*Vitis vulpina*), which is often gathered for making jelly, wine, or grape juice; and native gooseberries, raspberries, strawberries, hawthorns, and hazelnuts. Figure 42 illustrates fruiting branches of some native fruits.

PLANTING PLAN FOR THE HOME FRUIT GARDEN

Every farmer should make a planting plan of his fruit garden, so that he will have no difficulty in distinguishing the different varieties when they reach a bearing age and will be able to draw conclusions as to which varieties are adapted to his locality.

Figure 43 is an example of such a plan. Such details as the size and shape of the fruit garden, the varieties selected, and the distances of planting will vary with the different conditions of each farm. In the plan shown, rows of apples and crabs are 25 feet apart, rows of plums and plum hybrids 20 feet apart, and rows of small fruits 10 feet



FIGURE 42.—From left to right are shown fruiting branches of the native choke-cherry (*Prunus demissa* var. *melanocarpa*), golden currant (*Ribes odoratum*), Bessey cherry (*Prunus besseyi*), and buffaloberry (*Lepargyrea argentea*).

apart. The row of Bessey cherries and serviceberries (Juneberries) is spaced 15 feet from the row of plum hybrids on one side and 10 feet from the row of small fruits on the other. Apples and crabs are spaced 25 feet apart in the row; plums 15 feet, plum hybrids, apricots, and cherries 13 feet; Bessey cherries, Juneberries, golden currants, and grapes 8 feet; and raspberries, gooseberries, and currants 5 feet apart.

The following planting list for a farm fruit garden of about an acre is suggested for well protected sites in those districts on the northern Plains that have a comparatively long growing season. The rows are numbered from south to north and the varieties listed from east to west in the rows:

Row 1.—1 Florence crab, 2 Virginia crabs, 2 Whitney crabs, 2 Dolgo crabs.

Row 2.—1 Florence crab, 2 Oldenburg apples, 2 Wealthy apples, 2 Haralson apples.

Row 3.—2 Red Wing plums, 2 Terry plums, 2 Waneta plums, 2 Wyant plums, 1 Emerald plum, 1 Tecumseh plum, 1 Tokata plum.

Row 4.—3 Compass hybrids, 3 Opata hybrids, 2 Sapa hybrids, 1 Scout apricot, 1 Manchu apricot, 1 Coronation cherry, 1 Bessarabian cherry.

Row 5.—5 Success serviceberries (Juneberries), 3 Dwarf or other serviceberries (Juneberries), 3 Sioux Bessey cherries, 3 Brooks Bessey cherries, 3 Champa Bessey cherries, 3 Drilea Nanking cherries.

Row 6.—8 Golden currants, 6 Beta grapes, 6 Alpha grapes.

Row 7.—6 London Market currants, 5 Red Lake currants, 5 White Grape currants, 5 Houghton gooseberries, 5 Carrie gooseberries, 5 Pixwell gooseberries.

Row 8.—16 Latham raspberries, 15 Chief raspberries.

Row 9.—16 Cumberland black raspberries, 15 Sodus purple raspberries.

Strawberries or garden crops may be grown in the space between the fruit trees and the windbreak for several years, especially if water for irrigation is available. Such crops should not be planted closer than 10 feet to the fruit or windbreak trees.

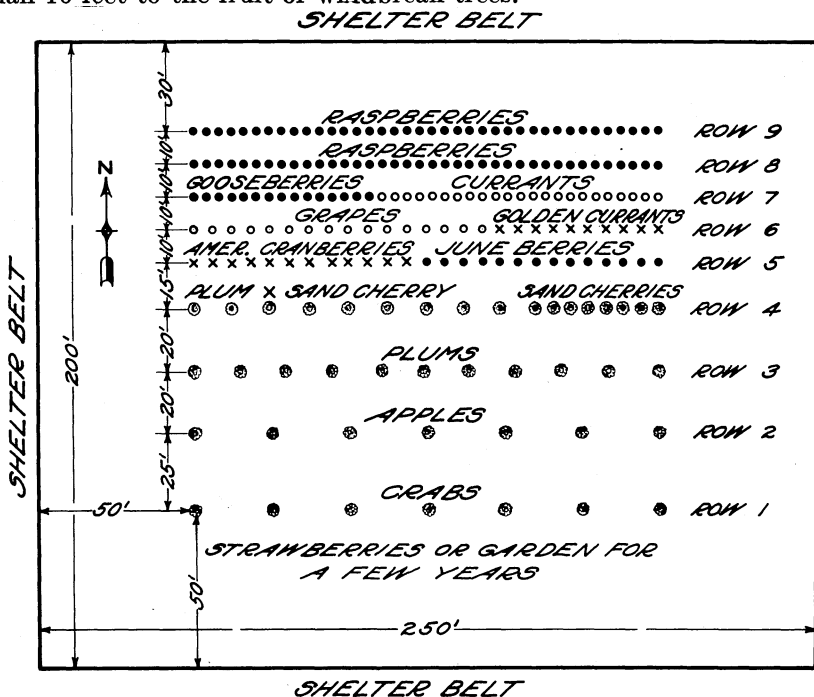


FIGURE 43.—Planting plan for a home fruit garden of about an acre.

If the site of the proposed fruit garden is not very well sheltered or if the district has an unusually severe climate or a comparatively short growing season (for the northern Plains), changes in the suggested variety list will be necessary. For such conditions the following varieties are suggested for trial:

APPLES.—None.

CRABS.—Dolgo, Silvia, Transcendent, Robin, Florence, and Amur.

PLUMS AND PLUM HYBRIDS.—Assiniboin, Opata, Compass, Cree, Ojibwa, Teton, Wyant, Wolf, and Mandan Selection 48.

SERVICEBERRIES (Juneberries).—Success and some others for cross-pollination.

BESSEY CHERRIES.—Sioux, Champa, and Brooks.

APRICOTS.—None.

CHERRIES.—None.

CURRANTS.—London Market, Red Dutch, and White Grape.

GOOSEBERRIES.—Carrie, Houghton, and Pixwell.

RASPBERRIES.—None.

NATIVE FRUITS.—Golden currants, chokecherries, native grapes, and others.